ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

They read "Electrical World" in Great Britain. In the "Electrician" a full-page editorial discusses our editorial on "Senseless Water Power Development" with approval and then applies the ideas to the much-advertised British Grid. Well, several years ago we stated that capital expenditures for this grid unassociated with load building merely meant added costs for existing service. The long-term plan is good, but it failed to stress sales as a necessary and immediate support.

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On the other hand, D. E. Lilienthal of the T.V.A., in his Memphis speech, intimated that we had "lost our shirt" in another editorial, in which we paid our respects, not to T.V.A., but to the whole program of putting the government in the power business. Well, time will tell who is right.

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At all events, these are stirring times with many changes. For example, we note that no new textile plants can be built without getting the permission of NRA. In other words, contemplate the picture—hereafter we must ask the government if we can go into business. And what does this policy do to revive the capital goods industry?

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That reminds us that our editorial staff is going to be busy trying to find out facts about the industrial market. We propose to interview industrial executives and engineers to find out if they want money for making purchases, if there is an opportunity to modernize or rehabilitate their plants and to get suggestions as to the magnitude of this market and how it can be sold. Somebody must do this, so we expect to do our part.

●

Slow speed ahead for the N.E.M.A. code. We note supervising agencies are not yet appointed. We find a few new price lists with a too-prevalent plus 10 per cent new price. We hear that some difficulty is encountered in getting some branches to submit price lists — a sort of let-the-other-fellow-do-it-first attitude. Misconceptions exist also even to the thought that prices will be uniform. All this is to be expected. No industry can reorganize itself in a brief period. On the whole, encouraging progress is being made.

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OCTOBER 28, 1933

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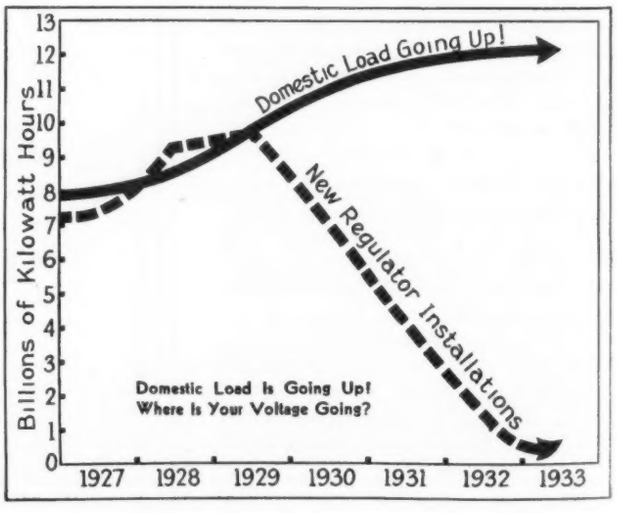

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GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1883—McGraw-Hill Publishing Company, Inc.

for the Week Ending

October 28, 1933

L. W. W. MORROW, *Editor*

Engineering—a Profession

BY LAW and by their own acts engineers are now trying to raise themselves to a high professional status. One aspect of this movement is the state licensing laws and another is the work of the Engineers' Council for Professional Development—a body representing the professional societies and the engineering educators. And back of these trends lie the notable research studies recently completed of engineering education and the long-desired objective of placing an engineer on a professional plane equal to or higher than that of the doctor or lawyer.

Now we have four committee reports of the E. C. P. D. bearing on the objective. These reports are recommendations and are incomplete and without approval of supporting bodies, but they are significant. They deal only with the engineer as a professional man and their premise is to take the broadest possible view of conditions and then make logical deductions. There is no attempt at regimentation or standardization, there is no endeavor to fix college courses or to specify the membership requirements of professional societies. But there is an endeavor to outline desirable objectives and to suggest lines of procedure.

One committee deals with the selection and guidance of high school and preparatory school students so that they may have information and guidance to help them determine whether they wish to become engineers or are fitted for that profession. The guidance and information aspects are comparatively simple, with stress upon the avoidance of solicitation or selling. But when it comes to selection the problem is more difficult. There are no methods to determine whether or not a young man is fitted to become an engineer and there is no pattern for an engineer. Then, again, the engineering colleges train men for all pursuits today and not alone for technical engineering, and these institutions, rightly, would not use a selection method to choose engineers only even if one were available.

Accrediting engineering schools and the basis for thus accrediting them is a recommendation of a second committee. Each course in each school is to be accredited and the basis is both quantitative and qualitative. The policies stated by this committee and the recommended procedure should be adopted. Whether we like it or not, the time has come for accrediting engineering schools.

Another committee is concerned with bringing the profession to bear in a helpful way with the student and with the young engineering graduate so that their professional development is had in the best possible way. This work involves contacts before and in college and in training after the student graduates. It seeks, very definitely, to introduce post-college engineering education; it seeks to get each young engineer to analyze himself and to develop a program for his professional advancement, and it seeks to bring the profession to bear upon this type of activity.

As a culmination, there is a committee on professional recognition. The profession is made a goal for attainment, based upon minimum qualifications and a programmed development. Certification as an engineer must be earned and

an engineer must be recognized as a professional man. In the opinion of the committee, the grade of membership in a professional society, a licensed engineer and the granting of a professional degree should be a simultaneous accomplishment based upon the minimum definition of the requirements for a man to be an engineer. It also recommends that grades of student member and junior member be established by each professional society in order to build the logical step-by-step development in a professional career. This recommendation refers only to professional grades of membership and places no restrictions upon any other type of membership each professional society may have if it so desires. This committee is concerned only with the standards of entrance to the profession.

Put in a nutshell, the E. C. P. D. is the profession applying its talents and resources to the selection and development of engineers. Its scope is "from the cradle to the grave." Its ambition is to put the engineering profession upon a high plane and to maintain it there. These preliminary reports show a grasp of the problem, a clear perspective and much daring but very logical thinking. At last we are on the road to professional unity and professional recognition according to a plan intelligently conceived and splendidly executed. The E. C. P. D. should have the aid and co-operation of every engineer.

A program for understanding rates

The clamor persists for low electric rates, simple electric rates, and rate forms that the public can understand. As pointed out by H. L. Hooker, president of the National Association of Railroad and Utilities Commissioners, recently the public believes in fair play and not persecution, but it does not understand utility rate forms. It cannot appreciate the variation of rates as between localities and between classes of customers. Nor does it know whether it pays a rate based on competent or incompetent management or on an obsolete or up-to-date property. In the opinion of Mr. Hooker the public must not only have a quick decision upon rate cases; it must also know that the rates are fair and understand how their fairness has been determined. In his opinion the "yardsticks" and the public ownership agitation find warmth and nurture in lack of recognition of these conditions by the utilities and by the regulatory commissions.

Thus, this often discussed and heretofore rather academic question has grown into a major public relations problem. Rate values and rate forms are in the public forum and no longer can be considered sacrosanct topics for secret industry discussions. The utilities and the commissions have made the public price conscious and "scientific" rates must give way to those that meet the ideas of the public. Rate forms must be understandable and rate decisions must be quick and clear to the lay mind.

Much of this is true, but the way out is psychological, rather than statistical or scientific. It is just as silly for the public to create an issue of the values it gets for 10 to 15 cents a day from electric service in the homes as it is for the utilities to maintain the present wide variety of rate forms and rate values on the plea that these are scientific. Practical rate making involves getting sufficient return to meet capital and operating necessities, to get and to hold business. If a property gets, say, $60 a year from the average domestic customer, any of several types of rates can be used to bring this return except for slight discriminations in terms of demand and energy use, and these are no more than exist because of those introduced by location with respect to the facilities on the properties.

There is more traditional than scientific basis for the variety of rate forms—flat, block, demand, inducement. It would be possible to attain the same revenues on each property by use of an identical form of rate, and it would be possible even to use a variable service charge and a uniform inducement energy charge to achieve this result. But this would change the bills of individual customers in both directions, with a consequent eruption of complaints from those whose bills were increased.

Action should be taken to conform to the present demand of the public. Both lower energy rates and more uniformity in rate forms should be instituted. Under present conditions the regulatory commissions are the best agencies to do this, for they have the authority and they can get together with the idea of bringing about national uniformity and simplicity in rate forms.

THE WEEK

Utility Workers Adopt Arbitration Plan

An employee organization through which employees of the Kansas City Power & Light Company will be represented in questions on wages and working conditions was approved by the employees in a recent election. Ballots were cast by 1,656 of the company's 1,800 employees, and 1,096 of the votes were in favor of the organization. Ballots favoring a convention by which another plan might be worked out totaled 560, but it was said that between 150 and 200 of those votes were cast by employees satisfied with the present arrangement.

The plan was taken before the directors of the company October 18 for final approval. Supervisory employees voted for the plan last week. It provides for nine departmental councils, each consisting of four employee representatives and four representatives of company officers and department heads. A higher council will consist of nine employee representatives and nine representatives of the management, appointed from the lower groups.

A director of employee relations, A. E. Bettis, who was named by the management, will attend and preside over all meetings, but will have no vote.

Company officials said the plan affected in no way any other organization or union in which company employees might be members.

An employee may make a complaint to the representative of his department and if settlement is not reached after a discussion in the lower group the problem will be taken to the higher council. Any dispute which cannot be settled in the council and in conferences with executives will be subject to arbitration for final decision.

When arbitration is necessary the board will consist of one employee and one executive who will appoint a third member.

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Birmingham Comments Sought

Birmingham Electric Company is sending out return post cards asking customers for constructive criticism of its service and the contacts of its employees with the public. This follows an announcement last week by President J. S. Pevear that the company considered the results of the recent election when municipal ownership was rejected but an added obligation to improve its service in every possible way.

▼

Valuation-Appeal Right Reaches Maryland Court

As the result of litigation growing out of the valuation of the property of the Potomac Edison Company by the Maryland Public Service Commission the right of a public utility to appeal from a tentative Public Service Commission valuation order and from a final valuation order has reached the Maryland Court of Appeals. Two appeals were taken by the company and associated or affiliated corporations from decisions of the Circuit Court of Baltimore City.

The question of the right to appeal from a tentative valuation was involved in the first case argued. This was an appeal of the companies from a decision of the lower court denying the companies' petition for an order dismissing their own bill of complaint and sustaining the commission's demurrer to the bill. The bill sought an order setting aside the commission's tentative valuation of the companies' properties. Subsequent to its filing, the commission fixed the final valuation.

Counsel for the appellant companies contended that the final valuation order superseded the tentative valuation order and that the sufficiency of the bill of complaint attacking the tentative valuation was a "moot question." It was urged that a moot question should not be decided and a bill of complaint giving rise to the question should be dismissed.

The attorneys for the commission contended that the demurrer of the commission was properly sustained by the lower court because "nowhere in the public service commission law is there any language authorizing an appeal to the courts from either a tentative or a final valuation of property by the commission."

▼

Ferguson Backs 2-Cent Rate for Fully Electrified Homes

"To break the vicious circle of small energy use and resulting high cost and vice versa in domestic electrical service, the completely electrified home must be able to earn a rate of 2 cents or less per kilowatt-hour," declared Samuel Ferguson, president Hartford Electric Light Company, before the New England System Operators Club at Greenfield, Mass., on October 20. Commenting upon why the average domestic use of electricity is low in the United States as compared with Canada, Mr. Ferguson said that it will not satisfy the American public to excuse and explain the high price, no matter how valid the reason. Such a vicious circle was broken in Canada fifteen years ago by the simple expedient of making a very low price (far below the then low cost), and making up the deficits from industrial users and by taxes for the period required to obtain the larger use through the stimulus of the low price, he pointed out.

"Not finding any one disposed to 'carry the bag' through the lean years while the load is coming up," said the speaker, "we must do the next best thing and offer rates which are reasonable for liberal use. By reasonable, I mean that a completely electrified house should be able to earn a rate of 2 cents or less for entire requirements of light, cooking, refrigeration, hot water, etc. This is an idea which has not as yet received universal acceptance, but in my opinion it must be done and done quickly, otherwise the public will compel radically reduced rates, and when the public is aroused it will not discriminate between small users and large ones, but will make the same low rate to all regardless of the inequity of a procedure which compels liberal users to pay the losses involved in service of small users below cost. We find much more profit in the all-electric homes earning rates as low as 1.7 cents per kilowatt-hour than we do in the average home at 4½ cents or the small user at 8, and certainly the users are more pleased."

T.V.A. Power for Memphis? $7,000,000 for Dam No. 3

At a conference with the Memphis Muscle Shoals board held last week David E. Lilienthal of the Tennessee Valley Authority announced that the federal government is willing to build a $6,000,000 power line from Muscle Shoals to Memphis if a survey indicates a large enough potential market. The result would be considerably lower rates to householders and industries both at Memphis and in the smaller cities and towns along the route. Mr. Lilienthal said the power could be brought to Memphis at rates no higher than the yardstick rates posted by the authority (ELECTRICAL WORLD, September 16, page 356). Distribution of energy through the same company that now holds the franchise could be arranged, Mr. Lilienthal said, if the company made its rates satisfactory to the authority.

An appropriation of $4,000,000 by T.V.A. for the manufacture of fertilizer at Muscle Shoals (ELECTRICAL WORLD, October 21, page 515) will probably be used in the erection of a new plant, Harry A. Curtis, chief chemical engineer of the authority, has announced.

The first legal action necessary to permit the Tennessee Valley Authority to acquire tracts of land needed for the site of the Norris Dam at Cove Creek was commenced recently when William A. Sutherland, general solicitor of the authority, filed two condemnation suits in the United States District Court.

$7,000,000 for Dam No. 3

Orders have been issued by President Roosevelt to Chairman Morgan of T.V.A. to allocate $7,000,000 to defray the first year's construction cost of Dam No. 3 near Muscle Shoals. This sum represents about one-third of the estimated cost of the dam, minus the hydroelectric power plant. It will be diverted from the funds allocated for construction of Norris Dam on the Clinch River in Tennessee. Since the Norris Dam is a three-year project all of the money set aside for its construction at this time will not be needed.

In the order from the President to the T.V.A. board the announcement is made that this dam will be built primarily for power. Just how this can be reconciled with the local conditions remains to be explained. Nor does this policy line up with the recent statement of A. E. Morgan, chairman of the T.V.A. board, to the effect that the latter would not oppose the building of this dam with P.W.A. funds, provided the T.V.A. was not required to take over the carrying charges.

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Standards Shift Discussed

Though agreements for the shifting of certain activities of the Department of Commerce to the American Standards

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Wind-Rotor Experiments "Decidedly Satisfactory"

Keystone

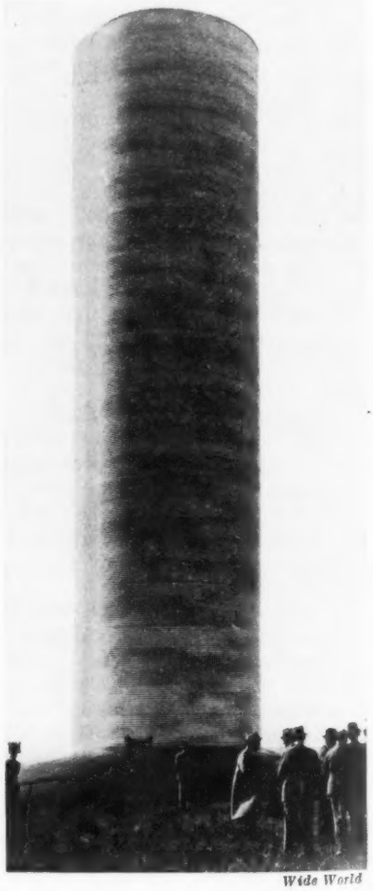
More than two years after the project was first announced (ELECTRICAL WORLD, October 3, 1931, page 574) the wind-rotor experiments for the generation of electrical energy at West Burlington, N. J., are reported by Julius D. Madaras, inventor, as "decidedly satisfactory."

In the test installation a tower mounted on a solid base and rotated by an electric motor has demonstrated the translational force developed under varying wind forces and speeds of rotation. The tower is about 90 ft. high, 28 ft. in diameter and develops a peripheral velocity of as high as 50 m.p.h. With a 10-m.p.h. wind and a peripheral velocity of 50 m.p.h. the tower showed a translational force of 8,000 lb. at right angles to the direction of the wind.

Originally sponsored by Public Service Electric & Gas, Middle West Utilities, Detroit Edison, Standard Gas & Electric, United Gas Improvement and United Light & Power companies the experiments have had the active interest of C. F. Hirshfeld, research engineer of Detroit Edison. Approximately $140,000 has been expended to date. If pushed to a commercial scale there will be at least a $2,000,000 project involved.

Illustrated are the tower, in rotation, and the driving motor under examination by Dr. Madaras, the inventor.

In the envisioned commercial installation twenty to a hundred motor-rotated duralumin - covered towers



Wide World

mounted on railway tracks would move along a circular track under wind effects producing electrical energy from axle-geared generators on the trucks supporting the translating towers (ELECTRICAL WORLD, May 28, 1932, page 914).

Association were reached several months ago (ELECTRICAL WORLD, July 29, page 129), representatives of industry and consumer groups met last week in Washington to discuss co-operative relationship further. No report of results following these discussions have been made public.

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Westinghouse Strike Off; 2,700 Workers Affected

Complete settlement of strikes at the East Springfield and Chicopee Falls, Mass., plants of Westinghouse Electric & Manufacturing Company are announced by Senator Robert F. Wagner, chairman of the National Labor Board, after conferences with both sides. Approximately 2,700 men and women are affected by the settlement. On the basis of these conferences the board rendered a decision which was presented formally to both sides and accepted by them.

It was agreed, with respect to the East Springfield and Chicopee Falls works of the company, that:

1. The strikers should return to work on Monday, October 23, 1933, without any discrimination.

2. The company will bargain collectively with the representatives of the employees selected in accordance with the provisions of Section 7(a) of the national recovery act. This bargaining will be conducted with the object of:

(a) Reclassifying occupations and establishing rates for each occupation, the number of rates for each classification to be reduced not to exceed three classifications in so far as practicable.

(b) Comparing the earned hourly rates paid by the company with those generally paid for similar work by other manufacturers in the industrial area and removing any inequalities disclosed thereby.

(c) Taking up any question of inequalities in earned hourly rates where no comparisons with similar rates paid by others are available as referred to in the above clause (b) and removing any inequalities disclosed thereby.

3. All readjustments of rates so arrived at jointly within six months from this date shall be retroactive to October 23, 1933.

4. The company will continue to study day rates and incentive tasks for the purpose of making appropriate adjustments as soon as possible.

5. When a new design is introduced the standard time rate will be the guaranteed rate for a period not to exceed three months. If at the end of this period standard time cannot be met the job will be restudied.

6. The company, while reserving full liberty of action in this respect, states that its present policy is to consider seniority in the retention of its employees when seniority and merit do not conflict.

7. Questions in dispute regarding this agreement are to be submitted to the National Labor Board.

Meeting the October Crisis

Those few words at the end of President Roosevelt's radio address to the nation, on Sunday night of this week, pointing to a buying-selling policy on gold and continued adherence to the previously indicated objective of a managed currency with a promise of a commodity dollar left the nation more confused than ever. Anti-inflationists were incoherently baffled. Inflationists were jubilant. Just another phase of the yes-no, perhaps-maybe bout with things as they are. All leading, the conservatives say, to the same end that has greeted every previous effort of this kind.

Figures of the week continue baffling in their lack of clearly defined trend. The positive determination by the Administration to secure avowed results is the best guide of outcomes for the next few months. Carloadings at 664,058, in the most recent weekly figures available, touched a high point for the year. Electrical energy production holds level of decline reached in the preceding week, but reduces the margin over 1932 sharply—to 5.7 per cent. Commodity price indexes stand at close to the year's high. Bituminous coal production shows gain of 1,000,000 tons in a week. General indexes up slightly after prolonged drop. Security markets, following the late last week slump, rebound sharply. Automobile production drops. National Industrial Conference Board reports further retardation in past six weeks of recession which began in July. Capital goods industries await developments.

Influences of the week have been those tending in an unorthodox manner to defeat the awaited October crisis. Plans for wholesale release of frozen bank deposits mature. Recognition of Soviet Russia in preliminary stages. Thirty-hour week again discussed. Merit clause ruled out of labor provisions of codes as unnecessary. NRA has not failed, one assumes, but is meeting an inevitable test of strength and ability to be continued.

N.E.M.A. Code Progresses; Supervisors Appointed

Supplemental codes for the major N.E.M.A. electrical manufacturing code are making splendid progress in some sections. Requests for the filing of price sheets have been sent out for 37 types of products and filing dates for 28 of these have closed. Further work has been the appointment of supervisory agencies for several product classifications, as follows:

Installation Devices — Robert Edwards. Appliances—Walter M. Stearns. Refrigeration—G. M. Johnston, W. F. Armstrong, H. E. Blood, Thomas Evans, G. W. Mason. Radio and Television Sets for Homes—A. T. Murray. Radio and Television Accessories for Homes—L. F. Muter. Radio Receiving Tubes—E. T. Cunningham, B. G. Erskine, H. W. Harper. Industrial Apparatus—C. L. Collens. Construction Material—E. H. Ott (subject to approval of one section). Prime Movers—F. W. Kennedy (temporary). Illumination—A. F. Hills, W. D. Steele, C. A. Orr. Portable Lamps and Shades—Michael Schwarz. Roughing in Material—F. C. Hodkinson. Wire and Cable—Wylie Brown, F. C. Jones, H. D. Keresey, D. R. G. Palmer, A. G. Newton. Dry Batteries and Flashlights—R. Gelarding, C. B. Plants, N. W. Cargill, C. P. Deibel, H. S. Schott. Electric Tools—L. M. Knouse (temporary). Telephone Manufacturers—G. A. Scoville, F. R. Burty, F. B. Gleason, G. A. Yanockowski, H. L. Harris.

Among the classes of products for which price list filings have been required are: Fuses, signaling apparatus, electric welders, industrial heating, manufactured mica, varnished fabric and paper, molded insulation, non-metallic conduit, outlet, switch box and conduit fittings, rigid conduit, flexible cord, magnet wire, alloy wire, rubber-covered building wire and radio receiving sets.

Progress is being made on cost accounting and on the development of statistics. Operations are proceeding quite rapidly and smoothly considering the magnitude and complexity of the tastes and the number of manufacturers and products involved.

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Cost Economies Sought Via Improved Industrial Lighting

Regional conferences on the economic value of improved industrial lighting were held recently at Hartford, Conn.; Providence, R. I.; Boston Mass., and Reading, Pa., under the auspices of the Holophane Company, Inc., and will be continued in New York and elsewhere during the immediate future. The basic appeal of improved industrial lighting at this time, it was pointed out, is its value in cost cutting in process work through enhanced production, increased safety and betterment of shop conditions. Under the NRA, it was stated, labor costs and raw material expenses are being increased, but plant modernization along illuminating lines is a worth-while objective in view of the efforts manufacturers of lighting equipment have made of late to provide designs applicable to a wide range of conditions without the necessity of making burdensome outlays for rewiring. Many new units are available to existing wiring installations without change.

In the discussion of lighting problems in various industries which featured these meetings, it was brought out that there is a marked trend at present to compromise beween local and general illumination. Striking progress has been made in the direction of providing units which redistribute light in areas of utilization by "stealing" it from directions of less value. In the field of gaseous tube lighting the fixture maker is doing considerable development work to attain good color mixing and distribution.

Coming Meetings

American Society of Mechanical Engineers—New York, N. Y., December 4-9. C. W. Rice, 29 West 39th St., New York.

American Physical Society, Pacific Coast Meeting—Stanford University, Calif., December 15-16. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—New York, N. Y., January 23-26. H. H. Henline, 29 West 39th St., New York.

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Associated Company Loses License in Massachusetts

Registration of the Associated Gas & Electric Securities Company, Inc., a registered broker, was revoked recently by the securities division of the Massachusetts Department of Public Utilities. In the order of revocation, Director Hull points out that the complaint against the company alleged: (1) Fraud in the sale of two 6 per cent convertible debentures of the Associated Gas & Electric Company; (2) that these sales were made by the respondent through a salesman not registered with the securities division.

Mr. Hull stated that testimony before his department revealed that one Melican, an employee of the Worcester Gas Light Company, sold to the complainant a $1,000 debenture certificate for which sale he was paid a $20 commission, although he is not registered as a salesman. "The complainant testified," Mr. Hull said, "that Melican at the time of the sale told him that he, the purchaser, 'could turn it in' and get his cash any time he wanted to; 'that it was just as good as money in the bank; you can draw it out any time you want to with 2 per cent off.'" According to Mr. Hull, Melican testified that he made the statement or similar statements to the purchaser and that, "we were told to tell the customers that they could get their money back any time they wanted it by presenting their bond to the main office in Worcester."

This evidence was not contradicted, although two witnesses were called by the respondent and each testified that he gave certain instructions to employees of the Worcester Gas Light Company regarding the sale of securities of the Associated Gas & Electric Company. The complainant further testified that he took his debenture to the office of the company and tried to secure the return of his money, but without success. An appeal for a hearing was filed by Associated Gas & Electric Securities Company.

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Live Wire Suit Decided

Mary E. Foss, widow of a Sioux Falls, S. D., farmer who was electrocuted by a high power wire during a storm last spring, has been awarded $2,500 in a verdict returned by a Circuit Court jury at Sioux Falls. Northern States Power Company, defendant, is considering an appeal. The deceased was instantly killed removing a wire which had blown down during a storm.

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Welding Holds Great Possibilities, Iron and Steel Electrical Engineers Hear

IMPETUS given to production of continuous sheets and strips by the streamline trend in the automotive industry vied with welding fabrication for major honors in the papers and discussions of the Association of Iron and Steel Electrical Engineers at the annual convention in Pittsburgh last week. Several authors chided the iron and steel production industry for still being blind to the enormous tonnage that awaits as soon as steel producers really join welding machinery producers in the promotional task. Welding, according to E. A. Hurme, has definitely emerged from the all-strength and no-ductility stage into one in which controlled technique will meet the needs of all but certain obstinate alloys, notably of the manganese type. Properly chosen coated electrodes or a shielded arc will produce a weld not different from parent metal produced in the electric furnace; in fact, both these methods simulate the controlled atmosphere of the electric furnace.

Half the tonnage (some 32,000,000 tons) of the steel industry replied to a questionnaire on welding practices and preferences. Forty per cent use welding in production and 60 per cent on plant maintenance, which shows that the production field has hardly been scratched. Single-operator sets constitute 91 per cent of those reported, although 60 per cent favor the multiple-operator system for mass production. Twenty-eight per cent use a.c. welders and of those who use both kinds 60 per cent prefer the a.c. No difference in deposit is found by 33 per cent, whether a.c. or d.c. be used, not one, however, reporting a comparative analysis of the weld qualities. It is also an open question whether there is any choice between a.c. and d.c. for cutting. Seven use coated electrodes for every three that use the bare rods. The only criticism of the automatic welding machine is on the high maintenance cost experienced. Percentage losses from stub ends of electrodes range from 7 to 25. Welding supervisors are employed by 87 per cent and 75 per cent have definite qualification tests for welding operators.

Bennett Chapple of American Rolling Mills prophesied a great future for welded houses. He pointed out that housing today is our most costly necessity and that welded sheet construction is as revolutionary an attack on the age-worn technique of building as the cotton gin and the steel plow were to the fields of clothing and food production.

Larger and more powerful mills

An ever-increasing demand from the automotive body and fender industry and the metal furniture industry for more sheet width and length has resulted in high-powered motor-driven mills involving some 50 hp. per inch of sheet width, and widths now run to 84 in. A flat and straight product demands control of the front and back tension on the sheet either side of each pass. Desirable values cited by Stephen Badlam are 1,000 to 2,000 lb. per inch of sheet width. Tension horsepower may thus amount easily to half the value of the power absorbed in reduction at the rolls. Adjustable-speed d.c. motors are provided in one scheme described by A. F. Kenyon, Westinghouse.

In the discussion of electric furnaces for bright annealing of coiled steel strip it was brought out by A. N. Otis, General Electric, that a bell-type furnace can easily save $2 per ton, practically the cost of the oil fuel, and halve the time to nine hours for a 6-ton charge and also reduce cooling time from 50 to 30 hours. All parts of the electric furnace can be brought up together with not more than 15 deg. ultimate variation, whereas a gas-fired furnace may necessitate holding the top of the charge at normalizing temperature for twenty hours while the bottom is coming up. This time difference for top and bottom must have some effect on the relative grain structure as well as that due to the much wider range of local temperatures. In manufacturing electric sheet he advocated the higher temperatures (2,200 deg. not too high) and the complete removal of moisture from the hydrogen furnace atmosphere. By this means a steel can be made having a 30 per cent reduction in magnetic losses because of the control of the silicon.

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Foshay Litigation Ends

All litigation in the receivership of Public Utilities Consolidated Corporation, W. B. Foshay Company subsidiary, has come to an end with the filing of stipulations and orders in federal District Court disposing of the E. C. Warner suits. Joseph Chapman, receiver, now is in position to proceed

with reorganization of the company and to dispose of details incident to termination of the receivership, Clark R. Fletcher, Mr. Chapman's attorney, has stated.

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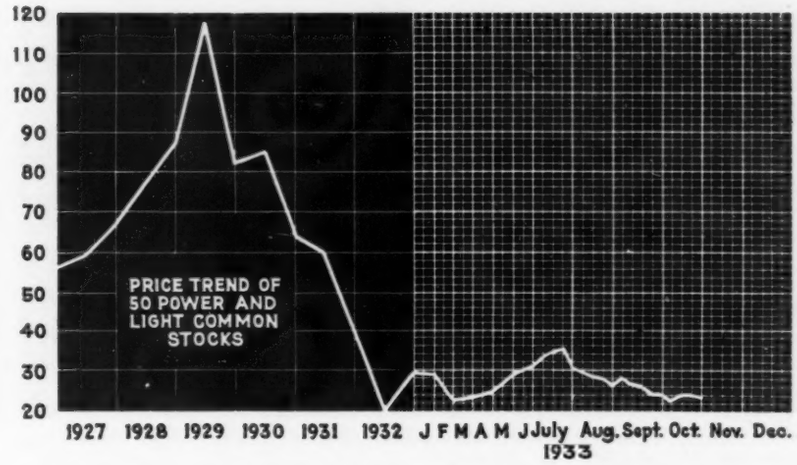
Security Sales Limited to Property Concerned

Operating utility companies, according to Milo R. Maltbie, chairman of the New York Public Service Commission, should not be allowed to sell and distribute any stocks or bonds unless directly secured by their own plant and properties. This opinion has been approved by the commission. The stand was taken as a result of a proceeding instituted by the commission upon a complaint alleging that the New York & Richmond Gas Company was engaged in the sale of securities of certain other corporations.

This ruling is based on the case of a Mr. O'Brien, an inexperienced investor, who was sold stock in the Central Public Service Corporation by regular employees of the New York & Richmond Gas Company when he understood that he was purchasing stock in the latter. Officers of the New York & Richmond company stated to the commission that their offices were used to sell the stock of Central Public Service because the two companies were then controlled by Col. Albert E. Pierce of Albert E. Pierce & Company and his associates.

Further Weakness in Utility Stocks



Despite the smart appreciation in general stock averages utility issues failed to show recovery beyond the sharp declines of late last week. "Electrical World" average 22.9; previously 23.7.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Alabama Power (Year ended August 31)					
Gross earnings	$15,427,901	$16,265,377	— 5.2	49	48
Net earnings	7,899,574	8,427,049	— 6.3	..	..
Net balance	888,540	1,501,486	— 40.9	..	..
Consolidated Gas, Electric Light & Power of Baltimore (Year ended August 31)					
Gross earnings	18,082,229	18,359,084	— 1.5	68	67
Net earnings	5,646,099	5,965,774	— 5.3	..	..
Net balance	3,014,286	3,459,116	— 12.8	..	..
Consumers Power (Year ended August 31)					
Gross earnings	26,188,660	29,141,096	— 10.1	55	50
Net earnings	11,794,138	14,600,086	— 19.2	..	..
Net balance	2,951,241	6,093,573	— 51.6	..	..
Detroit Edison (Year ended September 30)					
Gross earnings	41,767,071	45,119,324	— 7.4	68	70
Net earnings	13,305,337	13,718,714	— 3.1	..	..
Net balance	6,556,104	7,639,700	— 14.1	..	..
Duquesne Light (Year ended August 31)					
Gross earnings	23,833,573	26,207,148	— 9.1	43	43
Net earnings	13,557,143	15,002,875	— 9.6	..	..
Net balance*	11,001,989	12,640,886	— 13.0	..	..
Georgia Power (Year ended August 31)					
Gross earnings	22,040,542	23,319,541	— 5.5	48	50
Net earnings	11,586,677	11,653,560	— 0.6	..	..
Net balance	2,487,036	2,599,041	— 4.3	..	..
Kansas City Power & Light (Year ended August 31)					
Gross earnings	14,336,240	14,697,544	— 2.4	..	..
Net earnings	5,297,163	5,826,727	— 9.1	63	61
Net balance*	3,416,742	4,163,837	— 17.9	..	..
Northern States Power (Del.) (Year ended August 31)					
Gross earnings	31,145,325	33,174,239	— 6.1	60	58
Net earnings	12,374,777	13,925,112	— 11.1	..	..
Net balance	6,446,025	8,068,515	— 20.1	..	..
Puget Sound Power & Light (Year ended August 31)					
Gross earnings	12,645,617	14,237,778	— 11.2	62	61
Net earnings	4,795,696	5,562,774	— 13.8	..	..
Net balance	635,315†	656,410	—196.0	..	..
Tennessee Electric Power (Year ended August 31)					
Gross earnings	11,298,079	12,414,000	— 8.9	58	58
Net earnings	4,823,104	5,162,687	— 6.5	..	..
Net balance	605,578	1,014,371	— 40.3	..	..
Virginia Electric & Power (Year ended August 31)					
Gross earnings	14,737,718	15,993,246	— 7.8	64	65
Net earnings	5,337,742	5,530,198	— 3.5	..	..
Net balance	2,256,414	2,479,385	— 9.0	..	..

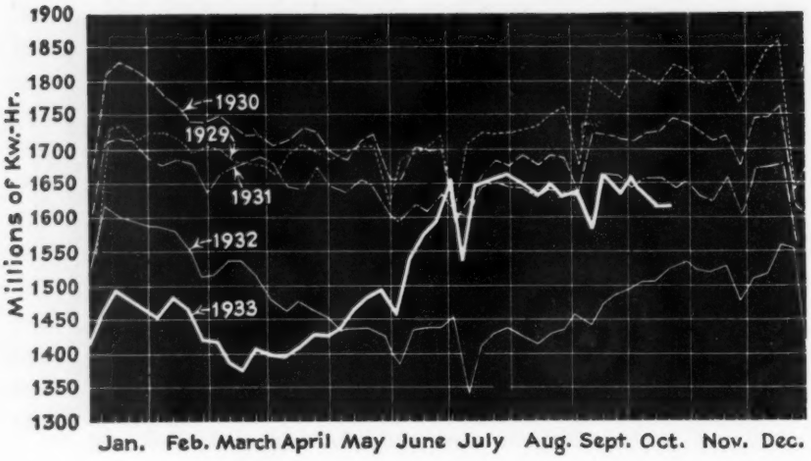
Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
American Gas & Electric and subsidiaries (Year ended August 31)					
Gross earnings	$62,850,134	$67,683,224	— 7.1	46	46
Net balance	7,848,859	11,163,852	— 29.8	..	..
American Power & Light and subsidiaries (Year ended June 30)					
Gross earnings	73,160,830	80,714,809	— 9.3	55	53
Net balance	6,152,089	12,639,394	— 51.3	..	..
American Water Works & Elec. and subsidiaries (Year ended August 31)					
Gross earnings	42,662,515	45,698,182	— 6.6	55	55
Net balance	2,297,123	3,737,843	— 38.6	..	..
Commonwealth & Southern and subsidiaries (Year ended August 31)					
Gross earnings	109,193,434	119,841,769	— 8.9	55	53
Net balance	312,843	8,056,491	— 95.9	..	..
Electric Power & Light and subsidiaries (Year ended June 30)					
Gross earnings	69,617,004	76,610,583	— 9.1	62	56
Net balance	740,412	7,702,853	— 90.5	..	..
Engineers Public Service and constituent companies (Year ended August 31)					
Gross earnings	43,006,067	48,388,227	— 11.1	63	65
Net balance	346,832	2,633,167	— 86.6	..	..
National Power & Light and subsidiaries (Year ended June 30)					
Gross earnings	68,450,800	75,309,829	— 9.1	60	60
Net balance	7,389,619	10,165,940	— 27.3	..	..
Philadelphia Company and subsidiaries (Year ended August 31)					
Gross earnings	45,505,985	51,336,525	— 11.4	66	65
Net balance*	7,500,501	10,375,083	— 27.6	..	..
Public Service Corporation of New Jersey and subsidiaries (Year ended September 30)					
Gross earnings	118,220,358	129,954,866	— 9.0	64	66
Net balance*	27,213,000	29,681,074	— 8.3	..	..

*Available for all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

Output Same as Previous Week's



Just maintaining the level of the preceding week, central station energy output of 1,618,795,000 kw.-hr. during the week ended October 21 exceeded that of the corresponding period last year by 5.9 per cent. At this time in 1932 the production curve showed pronounced upward trend, not repeated this year. Consequently the margin of gain has been narrowing. The mild recession in recent weeks leaves current production 1.7 per cent under 1931.

Gains continue strongest in the Rocky Mountain region. Percentages remain virtually unchanged in New England and the Central industrial area and diminished in the Middle Atlantic and Southern states. Two regions, the West Central and Pacific Coast, are about at last year's level.

Weekly Output, Millions of Kw.-Hr.

1933		1932		1931	
Oct. 21..	1,619	Oct. 22..	1,528	Oct. 24..	1,647
Oct. 14..	1,619	Oct. 15..	1,508	Oct. 17..	1,656
Oct. 7..	1,646	Oct. 8..	1,506	Oct. 10..	1,653
Sept. 30..	1,653	Oct. 1..	1,499	Oct. 3..	1,646
Sept. 23..	1,639	Sept. 24..	1,491	Sept. 26..	1,660

Per Cent Change from Previous Year

Region	Week ended Oct. 21	Oct. 14	Oct. 7
New England	+ 5.5	+ 5.0	+ 8.4
Middle Atlantic	+ 1.8	+ 4.6	+ 4.5
Central Industrial	+ 9.2	+ 9.9	+10.5
West Central	+ 0.0	— 0.0	+ 1.3
Southern States	+ 3.6	+ 8.2	+14.8
Rocky Mountain	+22.4	+22.1	+22.8
Pacific Coast	+ 0.7	+ 0.4	+ 2.7
United States	+ 5.8	+ 7.4	+ 9.3

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More Reports on 1932 Census

Continuing the series begun in the issue of October 7, preliminary statistics of the electric light and power industry for 1932 announced by the Bureau of the Census are presented herewith for ten additional states. This brings the total number of states for which figures have been thus far published to 28, those for Delaware, Maryland and the District of Columbia being combined in one group.

Quite uniformly the number of commercial establishments decreased compared with 1927, as a result of the centralization of ownership and the absorption of independent stations that took place especially during the earlier years of the quinquennium. With few exceptions the number of municipal establishments also decreased.

Steam turbines increased not only in aggregate rating but also in average size, as appears from statistics on the number of units (given in the Census bulletins but here omitted for lack of space). Reciprocating engines have been largely superseded, in contrast with the growing popularity of the internal combustion engine, notably in the Central states, the average size of units of the latter type being around 200 to 250 hp.

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Elaborate Fixture Display Opened by Manufacturer

An elaborate lighting-fixture display, comprising 26 rooms and individual display spaces in which there are more than 4,500 ceiling, bracket, duplex and switch outlets for showing fixtures in appropriate surroundings, has been opened in New York by the Lightolier Company. For the architect, builder or decorator who wants to see the different types of fixtures available for different periods, rooms, etc., the units are harmoniously grouped in separate rooms where they can be lighted separately. For those who want to see how units appear when isolated from all others, there are demonstration rooms, where various arrangements of furniture and lighting units can be studied. There are booths for determining the relative illumination provided by different units, direct-reading light-meters being available. The display of commercial units is not confined to the Lightolier Company's own units, but comprises other makes. Then, too, there are displays of units from foreign countries. An architects' consulting room affords privacy when a client wishes to be isolated from fixtures in which he is not interested.

One feature which makes this display unusual is that each of the numerous rooms is decorated to harmoni_e with the types of units displayed in it, thus removing the loft appearance that characterizes so many lighting fixture exhibits. For example there is a

Electric Light and Power Census of 1932 Compared With 1927

	Delaware, D. C., Md.		Mississippi		Virginia		North Dakota		South Dakota	
	1932	1927	1932	1927	1932	1927	1932	1927	1932	1927
No. of reporting establishments	39	47	33	55	47	52	35	79	71	84
Commercial	23	29	6	22	32	35	17	48	29	34
Municipal	16	18	27	33	15	17	18	31	42	50
No. reporting distribution only	19	18	3	2	18	11	7	18	23	33
Prime movers, total hp	1,226,753	695,284	91,254	87,454	568,468	501,775	104,445	56,136	99,259	70,514
Steam turbines, hp	813,866	653,441	58,207	58,260	427,342	395,936	84,135	35,598	56,070	37,497
Steam engines, hp	250	9,611	5,315	10,691	1,439	3,269	10,365	15,818	8,868	11,583
Int. comb. engines, hp	10,487	6,387	27,732	18,503	9,227	4,815	9,955	4,720	26,771	14,549
Hydro-turbines, hp	402,150	25,845	.....	.....	130,460	97,755	.....	.....	7,550	6,885
Generators, kw	857,067	498,294	65,669	63,887	409,468	364,633	70,400	36,094	66,929	48,172
Output, thous. kw.-hr	2,231,617	1,102,188	51,773	64,671	962,318	973,766	140,316	59,409	87,402	90,407

	Minnesota		Missouri		Nebraska		Pennsylvania		North Carolina	
	1932	1927	1932	1927	1932	1927	1932	1927	1932	1927
No. of reporting establishments	158	190	104	122	201	298	118	198	103	125
Commercial	38	55	51	69	35	56	78	158	37	40
Municipal	120	135	53	53	166	242	40	40	66	85
No. reporting distribution only	91	120	30	45	100	159	65	113	65	72
Prime movers, total hp	658,835	516,124	1,021,731	648,028	349,038	250,055	3,608,111	3,398,796	1,380,658	772,824
Steam turbines, hp	441,250	392,146	748,042	561,329	256,565	169,307	3,087,150	3,068,290	463,350	289,033
Steam engines, hp	26,407	33,525	18,580	34,805	15,411	25,677	37,176	40,656	4,796	7,911
Int. comb. engines, hp	15,986	6,717	49,896	29,757	57,111	33,453	17,070	12,740	8,258	4,157
Hydro-turbines, hp	175,192	173,736	205,213	22,137	19,951	21,618	466,715	277,110	904,254	471,723
Generators, kw	477,220	372,651	716,532	472,272	252,036	180,567	2,631,252	2,531,963	1,004,687	551,985
Output, thous. kw.-hr	995,182	843,357	1,214,478	891,179	561,795	405,056	6,373,552	7,501,975	1,651,235	2,036,122

The Administration will finance any sound municipal enterprise, including electric plants. That a private utility is in the field is no bar if its rates are excessive. The act provides that the United States must be reasonably secured for any loan.

HENRY T. HUNT,
General Counsel
Federal Emergency Administration of Public Works

Mr. Hunt took considerable pains in a radio broadcast last week to remove public doubts regarding the availability of funds for private utility competition.

Georgian room, a walnut-paneled room, a crystal room and a room for displaying wrought-iron fixtures. Then there is a reception room, a foyer, a modern living room, a dining room, a breakfast alcove and a room whose walls and ceiling make it easier to visualize the appearance of kitchen or bathroom fixtures. A two-story entrance of a Colonial house suggests possibilities of entrance lighting.

Several demonstration rooms with numerous floor outlets permit the study of arrangements of furniture and portable lamps and also enable furniture stores to experiment with the combined display of such equipment. In one of these rooms are demonstrated piano, floor, table and utility lamps which can give varying degrees of general or local illumination and which avoid the glare of lamps, bring out the beauty of shades and combine æsthetic appearance with utilitarian results.

The company has not only tried but succeeded in dramatizing lighting as an integral part of architectural design, affording facilities for combining engineered design with æsthetic appearance.

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General Electric Earns 24 Cents a Share to Date

Reporting upon the company's operations for the first nine months of 1933, General Electric shows sales billed in that period of $97,426,146.39, as compared with $113,049,474.95 for the corresponding interval last year, a decrease of 14 per cent.

Profit available for dividends on the common stock for the first nine months of this year, according to President Gerard Swope, was $6,886,600.45, compared with $9,726,395.22 for the first nine months last year. This profit is equivalent to 24 cents per share for the nine months of 1933, or 34 cents per share for the corresponding nine months of 1932, on 28,845,927 shares outstanding at both periods. Profit available for common stock for the third quarter of 1933 was $2,220,519.76, equivalent to 8 cents per share, compared with $2,073,207.61, or 7 cents per share, for the third quarter last year.

Orders received by the General Electric Company for the first nine months of 1933 were previously announced (ELECTRICAL WORLD, October 14, page 489).

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Business Committee to Study Unfair Trade Practices

A new committee of business leaders from various parts of the country has been selected by Gerard Swope, chairman of the Business Advisory and Planning Council for the Department of Commerce, to focus their experience on the problems of unfair trade practices in order to organize an effective attack on the vast economic waste now handicapping business as a result of such practices.

The new committee, Mr. Swope announced, to be known as "Committee on Unfair Trade Practices in Production and Distribution," will be headed by Lincoln Filene, treasurer and chairman of the board of William Filene Sons Company, Boston, Mass., who has long been identified with constructive efforts for furthering progress along these lines.

Other members of the committee include: Everett G. Griggs, chairman of the board, St. Paul & Tacoma Lumber Company, Tacoma, Wash.; Lucius Eastman, president Hills Brothers, New York City; Dr. Paul F. Nystrom, professor of marketing, Columbia University, New York City; L. D. H. Weld, director of research, McCann-Erickson, Inc., New York City; Roy Dickinson, president the Printers' Ink Publications, New York City; John S. Burke, president B. Altman & Company, New York City; James A. Goldsmith, president, Hess & Goldsmith, New York City; Morris E. Leeds, president, Leeds & Northrup Company, Philadelphia, Pa. Additional members of the committee are to be appointed.

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Westinghouse Lost $1,500,000 in Quarter

Sales billed by the Westinghouse Electric & Manufacturing Company for the third quarter of this year amounted in value to $17,474,213, against $17,482,376 in the corresponding period last year and $15,926,335 in the second quarter of 1933. Orders received amounted to $22,547,717, against $17,557,964 and $14,126,064, respectively.

Bookings have exceeded net sales billed for the second successive quarter, and they were larger in the third quarter than in any three months since the third quarter of 1931.

The net loss of the company amounted to $1,513,645 for the third quarter, comparing with losses of $2,078,424 in the preceding three months and of $2,715,123 in the third quarter of 1932. Unfilled orders increased from a low point of $23,337,000 to $28,508,000 on Sept. 30, 1933.

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Major New Construction This Week

Otter Tail Power Company, Fergus Falls, Minn., plans new transmission line in vicinity of Ayr, N. D. Permission granted.

Motors, regulators, substation equipment, conveyors, etc., required by Continental Distilling Company, Philadelphia, Pa. A $1,000,000 project.

Cape Girardeau, Mo., soon takes bids for complete city-owned electric light and power plant. Bond issue of $685,000 being arranged.

Power substation equipment, motors, regulators, etc., will be installed in Los Angeles, Calif., plant of Chrysler Corporation. Cost about $100,000.

Navy Department, Washington, D.C., has secured $858,500 for relocation of naval radio station at Pearl Harbor, Hawaii, and purchase of new equipment; $619,500 for similar program at Summit, Canal Zone, and $293,000 for Annapolis, Md.

Motors, conveyors, hoists, etc., will be installed by Armour & Company at Indianapolis, Ind. Cost $100,000.

Sahara Brewing Company, Topeka, Kan., plans $150,000 plant.

Complete electrification of cotton mill at cost of $200,000 to be made by Appleton Company of Anderson, S. C.

Appalachian Electric Power Company plans $200,000 substation near Danville, Va.

Motors, regulators, hoists, conveyors, etc., will be installed at new tipple of Northwestern Mining Company near Ridgway, Pa., at cost of $100,000.

G.E. Adds Employees

Approximately 7,600 employees have been added to the payrolls of the General Electric Company since March 1, and the total annual payroll rate is today $17,000,000 greater than it was on that date, Gerard Swope, president, has announced. According to President Swope NRA requirements have necessitated but little change in the company for the maximum work-week since May 1, 1931, has been only 40 hours and there were but few employees whose pay was at a lower rate than that prescribed by the code.

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New York Metal Prices

	Oct. 17, 1933 Cents per Pound	Oct. 24, 1933 Cents per Pound
Copper, electrolytic	8.00	7.50–7 62½
Lead, Am. S. & R. price	4.25	4.00
Antimony	6.875	6.75
Nickel ingot	35.00	35.00
Zinc, spot	5.12	5.12
Tin, Straits	46.50	47.125
Aluminum, 99 per cent	23.30	23.30

As to Rates——

• Union Gas & Electric Company, Cincinnati, must reduce its rates for electricity 37½ per cent, according to the provisions of an ordinance passed last week by City Council. The ordinance will not be effective for 30 days, during which time the company may appeal to the State Utilities Commission. The reduction would cost the company approximately $4,000,000 a year. Council's order is viewed in many quarters as a political move to influence the election scheduled for November 7, at which citizens are to decide whether or not the city shall purchase the utility facilities furnishing electric and gas service.

• Consolidated Gas Company's injunction suit involving its electric properties in New York City and Westchester was adjourned by Justice Sydney Foster of the Supreme Court at a hearing held last week at Kingston, N. Y., when he was advised that a rehearing of the rate case now is pending before the Public Service Commission. The reduction, ordered effective September 1, was held up by a temporary injunction until a permanent injunction could be passed upon. The latter is the issue before the court. The companies involved contend that reducing rates would tend to interfere with their ability to participate in President Roosevelt's re-employment agreement, and probably would force them to reduce working forces.

• Indiana—A statement made public by D. C. Hess, superintendent of the municipal light plant at Richmond, Ind., covering the costs of his plant, helped considerably the cause of the public utility companies protesting the elimination of discounts and penalties by the Public Service Commission (ELECTRICAL WORLD, October 14, page 490). He said that at the city plant it costs 19.9 cents a bill to collect those not paid by the expiration of the discount period. From penalties collected the plant realized 22.4 cents a bill on the average. Immediately, Perry McCart, head of the commission, declared that the commission had been misinterpreted and that there was not any intention to eliminate fair discounts and fair penalties. He said the whole intention of the commission was to eliminate high penalties. The Richmond plant, as most of the others in Indiana, charges 10 per cent penalty.

A plea of a utility company of increased operating expense under the national recovery act will bear no weight with the Indiana Public Service Commission, it appears, unless accompanied by evidence showing whether or not added revenue also may result. This interpretation came out of a hearing in which the commission, represented by the public counselor, is seeking a rate reduction. When the point came up, Howell Ellis, former member of the commission and now counsel for a number of patrons, called the commission's attention to a Maryland Public Service Commission ruling which held NRA costs should be borne by the company and not by the patrons. Utilities contend that it is highly speculative whether any increased business will result from the establishment of the NRA. Indiana commission members contend, however, the purpose of the NRA is to increase business.

• Public Service Company of Indiana indicated at the rate reduction hearing continued before the Public Service Commission (ELECTRICAL WORLD, October 21, page 522) how 1930 price levels have been used to establish values in rate making. Donald Cook, company witness and accountant for the appraisal firm of Spooner & Merrill, told that his company's appraisal made in 1929 was readjusted to 1930 price levels. The company is seeking to establish a valuation of $50,000,000 as a rate base.

• Gasconade Power Company on October 18 filed with the Missouri Public Service Commission at Jefferson City a new schedule of rates for residential, commercial and industrial electric service in nineteen towns in Central Missouri. It is anticipated the new schedules will save the company's customers about $14,000, or 12 per cent, annually.

• Puget Sound Power & Light Company, Washington Water Power Company and Pacific Power & Light Company, carrying their case to the Superior Court, are protesting the order of the State Department of Public Works ordering reductions of from 10 to 35 per cent in 1933 irrigation and spray rates (ELECTRICAL WORLD, August 19, page 233). At the hearing before Judge John M. Wilson of the Thurston County Superior Court counsel for the companies contended that the department exceeded its authority, violated the federal Constitution and state laws and acted arbitrarily and without justification.

• Lakeland, Fla., through City Manager Charles Larsen, has announced reductions in the rates of the local municipal plant. The minimum rate is to be reduced from $4 for 30 kw. hr. to $1.30 for 23 kw.-hr., the new scale ranging from 6 cents per kilowatt-hour for the first 500 to 2 cents for 5,000 or more kilowatt-hours in the commercial classification.

• Staten Island Edison Company has been ordered by the New York Public Service Commission to reduce all bills for electric metered service to general consumers by 10 per cent for one year, effective October 25. This will mean an estimated saving to consumers of $250,000. In his opinion Milo R. Maltbie, chairman of the commission, cited figures which he said indicate no marked effect of the depression on the company. He found that excess of income over 6 per cent on the "rate base" was $587,435 in 1932, $670,937 in 1931, $561,753 in 1930, $545,730 in 1929 and $476,541 in 1928. These and other figures "show that compared with the prosperous years prior to 1930 the returns during the depression years 1930 to 1932 exceeded the earnings in prior years except in 1924, 1925 and 1926."

• Queensboro Gas & Electric Company has obtained an extension of time from October 10 to and including November 1 for the 18 per cent cut in rates (ELECTRICAL WORLD, September 9, page 330). The extension was granted to give the commission time to reach its decision on the rehearings which have recently closed.

• San Joaquin Light & Power Corporation's distribution system in the city of Fresno, Calif., will be involved in valuation proceedings within the next month as the result of dismissal of objections of the utility company to such proceedings by the California Railroad Commission. May 8, 1934, has been set tentatively as the date on which hearings before the commission will actually start.

• Los Angeles, Calif., City Council has adopted ordinances authorizing the city attorney to proceed with a thorough survey of public utility rates and has appropriated $22,000 to finance the work.

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Municipal Items

FORT COLLINS, COLO.—Business men of this city have asked the public works board to approve a loan of $745,000, proceeds of which are to be used for the erection of a municipal electric light and power plant. The city is now served by the Public Service Company of Colorado, which, it is said, plans to oppose the loan.

O'FALLON, ILL.—Mayor Ralph Kampmeyer has called a special election on November 29 to pass on proposals that the city construct a municipal light and power plant and issue $145,000 in bonds to finance the plant. The city has already applied for a $145,000 grant and loan under the national industrial recovery act. The plant would be furnished with steam-generating equipment. The total cost of the project has been estimated at $143,200.

DONIPHAN, MO.—In a hearing before the State Advisory Board of the Federal Public Works Administration held in St. Louis the Missouri Electric Power Company opposed the application of city officials for a $24,027 grant and $63,973 loan under the national industrial recovery act to finance a municipal electric light and power plant and distribu-

tion system and improvements to the municipal water works system. The board took the application under advisement. Doniphan will vote November 3 on a bond issue to cover the loan.

CINCINNATI, OHIO. — Municipal ownership of the gas and electric companies of this city is opposed by Federated Civic Associations. Twenty-two association delegates have voted on the subject and twelve voted against the plan. A general election will be held November 7.

EAST LIVERPOOL, OHIO.—Secretary of State George S. Myers of Columbus has been requested by the Columbiana County Board of Elections and Prosecutor George L. Lafferty to join them in fighting the temporary injunction obtained by the Ohio Power Company restraining submission of a proposed $998,640 bond issue for a municipal power plant in this city to a vote November 7.

OGDEN, UTAH.—In an opinion written for the city commission, Stuart P. Dobbs, city attorney, finds numerous points upon which controversy might be based in regard to municipal power plants. Specifically dealing with the proposal for a plant for this city, he cites several provisions of the Granger act, passed by the last Legislature, which appear in conflict with the aims of such a proposal. The conclusion of his opinion is that the petition relating to a plant cannot come before the voters until 1935 because the petition was not presented until September 11, 1933, and that 90 days must elapse before it can be brought to a vote. The November 7 municipal election will occur prior to the expiration of the required 90 days. The next municipal election will be in November, 1935.

YOUNGSTOWN, OHIO, voters will decide on November 7 whether or not a $500,000 bond issue shall be made to enable the acquiring and installing of electrical equipment for the transmission of electricity and for the purpose of supplying electricity to the corporation and the inhabitants thereof.

BEDFORD, IND.—At a recent meeting of the City Council the initial step toward the erection of a municipally owned electric plant was taken when the Mayor appointed a special committee to investigate means of financing it. Funds for its erection will be sought through a loan from the Reconstruction Finance Corporation.

TRENTON, MO. — A special election will be held November 14 on a $250,000 bond issue to finance a municipal light and power plant. The city plans to apply for an $84,000 federal grant to help finance the power plant and distribution system, estimated to cost $334,000.

KENNETT, MO.—The State Advisory Board of the Public Works Administration in St. Louis, Mo., has under advisement the application of Kennett for a $36,500 grant and $103,500 loan to finance a municipal light and power plant and distribution system (ELECTRICAL WORLD, October 7, page 459). At a hearing held by the Advisory Board on October 19 representatives of the Arkansas-Missouri Power Company, which serves the city under a franchise which does not expire until 1935, voiced their opposition to the city application for the federal funds.

JEFFERSON CITY, MO.—State Senator Donnelly of Lebanon, Mo., administration leader in the upper house of the Missouri General Assembly, on October 20 introduced four bills to carry into effect Gov. Guy B. Park's plan to aid towns of less than 75,000 population to establish municipal light and power plants and distribution systems, gas systems, water works and sewer systems and to pay for such plants solely out of their earnings (ELECTRICAL WORLD, October 21, page 518).

SALT LAKE CITY, UTAH — On the contention that it violated fair play rules a sample publicity pamphlet drawn up by sponsors of the municipal power plant proposal for distribution to voters has been rejected by the city legal department. Under terms of the state initiative and referendum laws, through which the proposed power plant ordinance will be brought to a vote, the city is required to distribute to voters at its own expense arguments prepared by both foes and advocates of the measure. Sponsors of the project consented to revise the document.

WAGONER, OKLA.—Litigation in the United States District Court for the Eastern District of Oklahoma which has been in this and state courts for the past six years, involving purchase of a municipal electric plant by the city of Wagoner from Fairbanks-Morse & Company, seems to have reached a final stage. On September 27 Judge R. L. Williams advised the attorneys in the case that the only question before the court was whether or not the contract under which the equipment was purchased places any tax burden on the taxpayers of Wagoner. He allowed Fairbanks-Morse 30 days in which to file a brief on this point and the city ten days thereafter in which to file a reply brief. In discussing the case Judge Williams said he was afraid that the property purchased from Fairbanks-Morse had cost too much and that if any qualified Wagoner citizen raised this question he would appoint a special master to determine the fact. The Wagoner citizens who have contested the purchase of this plant for six years have claimed throughout the period of litigation that the purchase price of approximately $55,000 was at least $15,000 too high.

ALABAMA—Several towns located in the Tennessee Valley voted favorably last week on municipal ownership. Bessemer, a suburb of Birmingham, voted 484 to 394 for a light plant and 476 to 410 for a water plant. Seven towns in addition to Bessemer have voted in favor of municipal ownership and two, including Birmingham, against it.

Faster and Better Billing

Acme

Ecstatic demonstrators at the National Business Show in New York pointed to the ten-second maximum that this machine requires to produce a complete electric, gas and water bill, printing name, address and amounts of charges. Errors were said to be eliminated by an automatic stop bell alarm and suspended operations until rectified.

Carrier-Current

By PHILIP SPORN
American Gas &

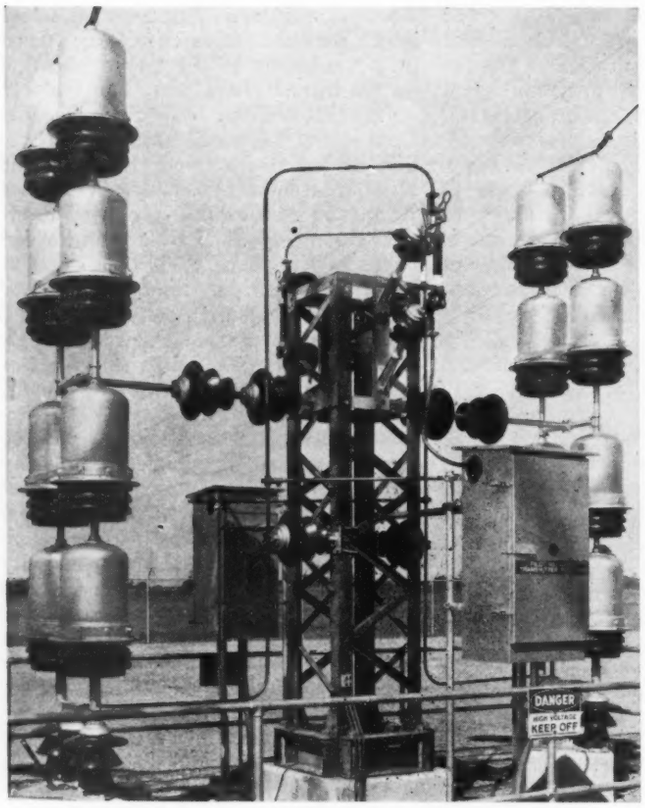


Fig. 1—Complete outdoor carrier equipment for two 132-kv. circuits

The coupling capacitor assembly for each circuit consists of eight units assembled in a 4 x 2 series-parallel connection, each unit being rated 0.001 mfd., 46 kv. Each capacitor assembly is connected for phase-to-ground coupling. The grounding switch and protective gap is mounted on the base of the capacitor stack. The lead-ins from the low-voltage ends of the capacitor assemblies are connected to the respective outdoor carrier-current cabinets through fused disconnecting switches. The drain coils are located inside the cabinets and are connected to the lead-ins ahead of the fused disconnecting switches. The cabinets as well as the bases of the capacitors stacks are grounded to the station ground with No. 4/0 copper conductors. A pipe framework inclosure prevents employees from coming in contact with live parts, but does not prevent testing of the carrier-current equipment in the outdoor cabinets.

THE application of carrier current for pilot-wire protection of transmission lines to give complete and rapid protection to any line section over its entire distance, regardless of the type of fault and independently of the number of line sections, has long been recognized. Of the numerous schemes employing carrier current for pilot-wire protection that have been tried out the method employing directional power relays at each station to determine, in combination, whether the fault is an internal or an external fault and to control transmission and reception of carrier current has proved to be the most practical and reliable system. Exhaustive tests of the first practical circuit embodying these ideas were made two years ago and have been previously described in the ELECTRICAL WORLD.* These field tests demonstrated that this system of carrier-current pilot protection was simple, workable and reliable.

In the original installation the relay equipment and the carrier-current equipment, including the transmitter, receiver, output transformer and line-tuning equipment, were mounted on a common panel indoors. It was found, however, that the operation of the installation could be greatly improved and its costs substantially reduced by several changes. A weatherproof outdoor cabinet, illustrated in Figs. 1 and 2, was developed in which the carrier-current equipment was mounted and which could be installed in the switchyard near the coupling capacitors. With this arrangement a more economical and efficient coupling circuit was obtained due to the elimination of the long carrier-frequency leads from the coupling capacitor to the indoor panel. This made possible the isolation of the relay equipment from the carrier-current equipment, which is very desirable as it gives the switchboard designer more freedom to arrange the carrier-current relays and other back-up protective relays on the panel to the best advantage. Further, it makes it more convenient for him to utilize such relays as are common to both the carrier-current protective system and the back-up protective system, as, for example, the same power-directional relays.

Use of station battery effects simplification

In the original installation the power supply for the carrier-current equipment was obtained from a small rotating inverter connected to the station battery. All tubes were operated from this a.c. supply and the plate and bias voltages for the tubes were obtained by means of a step-up transformer, rectifier and filter system. Since the rotating inverter had to operate continually, it was necessary to install two duplicate machines, one to act as a spare in case the other should fail. This arrangement of power supply was rather cumbersome, involving, as it did, inversion from the station battery voltage to 60 cycles a.c. in the rotating inverter and back again to d.c. in the rectifier. Consequently the power supply system, illustrated diagrammatically in Fig. 3, for the transmitter and receiver tubes was worked out so as to make it possible to operate all the tubes directly from the station control battery, thereby eliminating the rotating inverters and rectifiers. This simplification of power supply system was made possible due to the increased efficiency of the coupling circuit obtained by locating the carrier-current cabinet outdoors near the coupling capacitors, so that the losses which had been previously occurring in the long carrier frequency leads had been practically eliminated.

On the first installation interphase coupling, using two 0.001-mfd. capacitor assemblies, was employed, which resulted in a rather expensive coupling. It was found possible, however, to use phase-to-ground coupling and also to reduce coupling capacity, thereby simplifying and re-

*"*Carrier Current Relaying Proves Its Effectiveness," by Philip Sporn and Charles A. Muller,* ELECTRICAL WORLD, *September 10, 1932.*

Relaying Simplified

and CHARLES A. MULLER
Electric Company

- Outdoor installation of transmitter and receiver gives more efficient coupling and simplifies relay arrangements.
- Use of station battery for carrier circuits results in further simplification.
- Phase-to-ground coupling reduces coupling cost almost 75 per cent.
- Application of carrier-current relaying to long high-voltage tie between two large power systems.
- Improving oscillator stability to secure uniform carrier transmission under different operating set-ups.
- Unique application of carrier relaying to short double-circuit line to clear double-circuit faults.
- Operating experience proves reliability.

ducing the installation cost of coupling to the high-voltage lines. The result of this was an adaptation of the carrier current set for phase-ground coupling as illustrated diagrammatically in Fig. 4. With this arrangement it was necessary to employ only one 0.0005-mfd. capacitor assembly, thus resulting in decreasing the cost of coupling to high-voltage lines by almost 75 per cent.

Relaying long high-voltage tie between two large systems

During the past year ten carrier-current relay installations were put in operation on the double-circuit section between Howard and Fort Wayne sectionalizing stations on the 132-kv. system (Fig. 5) between Philo and Twin Branch generating stations. These two stations, in turn, tie in very extensive 132-kv. networks totaling some 4,000,000 kw. of generating capacity. On this 300-mile sectionalized tie line it was essential that all types of faults, such as ground, phase-to-phase and simultaneous faults on two circuits, be cleared as rapidly as possible in order to keep within the stability limits of the tie line. To obtain high-speed clearing of faults all the 132-kv. oil circuit breakers were converted to high-speed operation (6 to 8 cycles), and balanced duo-directional protection, instantaneous overcurrent protection and carrier-current relaying on the double-circuited section were installed. Only a carrier-current system offered fast relaying in case of simultaneous trouble on two circuits, and at the same time insured, in case of either single-line or two-line faults, that all breakers on the section in trouble would trip simultaneously. Cascading of oil circuit breakers would result in too slow clearing.

Because of a number of unusual conditions on this type of tie line the arrangement originally employed with carrier current relaying could not provide the desired protection. One of the conditions was the value of the normal load current, which, especially in case of single-line operation, is nearly equal to the short-circuit currents obtainable. In order to prevent continuous operation of the transmitter and receiver for long periods of time it would be necessary to set the carrier current starting and tripping relays for phase protection at high pick-up values, thereby decreasing the sensitivity of protection considerably.

Another difficulty was introduced by the load swings, sometimes reaching very large values, that occur over such a tie line in both directions, carrying with them the possibility of opening up of the line from either the carrier current relays or back-up protective relays. A third problem was introduced by the small values of ground currents that were obtainable on certain sections of the line, making it difficult for the standard ground starting and tripping carrier current relays to function rapidly.

To take care of these conditions the carrier current relay arrangement shown diagrammatically in Fig. 6 was developed. In this scheme for phase-to-phase protection the current-starting relays have been replaced by instantaneous undervoltage starting relays, which normally short circuit the current coils of the phase-tripping relays for both the carrier current relaying and for the back-up relays; these also control the starting of carrier transmission. By means of the voltage starting relays, it is possible to set the various phase tripping relays as sensitively as desired regardless of the normal

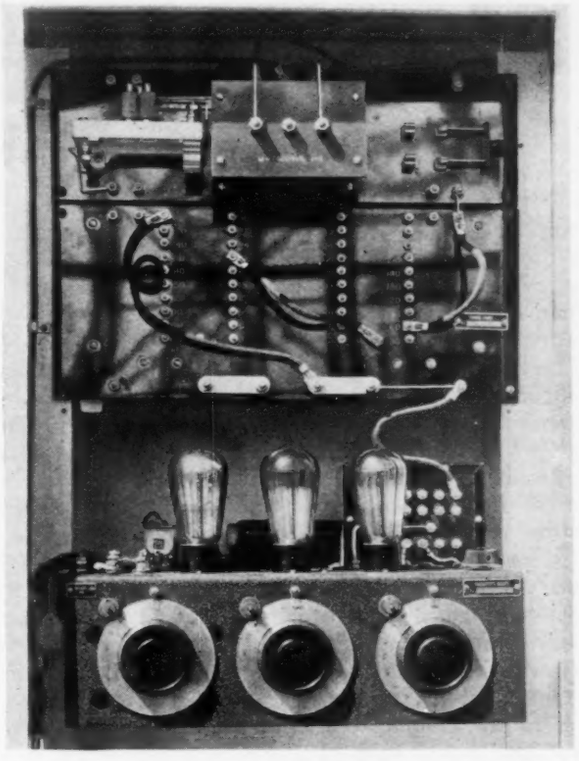


Fig. 2—Carrier-current equipment in outdoor weatherproof cabinet

The complete carrier-current equipment including the transmitter, receiver, output transformer, drain coil and line-tuning equipment are mounted in this outdoor cabinet. The equipment in the cabinet is connected to the indoor relay panel by means of a four-conductor, No. 19/22 lead-covered cable. Two conductors furnish the tube power supply, the third conductor connects the starting relays and the transmitter tube plate circuit, and the fourth connects the receiver relay and the plate circuit of the receiver tube.

load currents that may exist on the tie line. On this particular installation the voltage starting relays were actually set to operate when the phase voltages dropped to approximately 80 per cent of normal. To obtain fast operation on ground faults the directional element of a type IB ground directional relay was employed with the negative sequence voltage obtainable stepped up three-to-one by means of auxiliary potential transformers. With this arrangement it was possible to make the ground starting and tripping relays operate as fast as the corresponding phase relays.

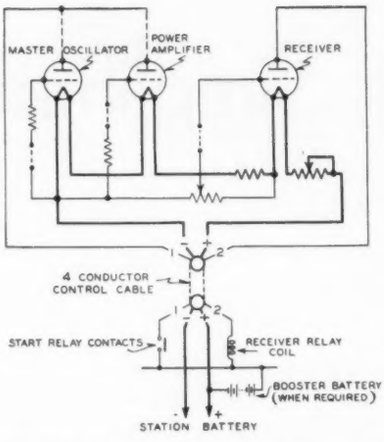
Uniform carrier transmission under different operating set-ups

During the final installation tests made on the carrier-current-relaying equipment for the 132-kv. double-circuit lines from Howard to Fort Wayne stations it was found that the amplitude of the carrier signal transmitted and received under various system set-ups possible under actual operating conditions differed considerably between set-ups. This variation in amplitude was sufficient to affect the reliability of the carrier-current relaying. Upon investigation it was found that the master oscillator did not control the generated frequency within sufficiently close limits to prevent a variation in amplitude of the carrier signal. Further, it was found that the variation of the master oscillator frequency was due partly to inadequate by-passing of the control leads between the switchboard and the outdoor carrier current cabinet. This was aggravated by the fact that the master oscillator did not exercise complete control of the frequency generated.

Another difficulty arose in the case of the Howard-Fostoria-Lima circuits, which have three sectionalizing terminals employing carrier-current relaying operated on the same carrier frequency. It was found that when any two transmitters were operated simultaneously they would lock in step on the same identical frequency, causing the amplitude of the received signal at the third station to be reduced to a point where the receiver relay would not function.

As a result of further development work, the stability of the master oscillator was increased to a point where the control of the generated frequency was rendered substantially independent of the above-mentioned factors. This was accomplished largely by altering the constants of the master oscillator circuit. To prevent two transmitters drifting into step in case of a three-terminal line section, the three transmitters were arranged to operate on slightly different frequency assignments. This frequency difference amounted to approximately one-half of 1 per cent, which was adequate to prevent any two transmitters from locking in step, but did not prevent all other carrier adjustments from being made on the basis of a single operating frequency.

A rather unique application of carrier-current relay protection was developed and is now being installed on the Philo-Zanesville-Crooksville lines. These 132-kv. circuits (Fig. 5) are very short in length, and when simultaneous faults occur on both circuits, the shock to the 132-kv. system is extremely severe and results in opening the tie line between Philo and Twin Branch stations unless such faults are cleared very fast. Due to the infrequent occurrence of such faults, the cost of installing complete carrier-current-relaying equipment at all six terminals was not warranted. Therefore, a scheme



The filaments of the transmitter and receiver tubes are connected in series through resistors across the station battery. The grid biases for the master oscillator and power amplifier tubes are obtained by the customary grid-leak resistors. The grid bias for the receiver tube is obtained by a resistor connected between the power amplifier and receiver tube filaments, this adjustment being made variable by the use of a potentiometer connected between the receiver-tube filament and the negative of the station battery. The plate voltage for all tubes is obtained from the plus of the station battery directly in case of a 250-volt battery and from the plus of the booster battery in case of a 125-volt battery. The normal drain on the booster battery is negligible, hence standard heavy-duty type "B" batteries may be and are employed.

Fig. 3—Simplified power supply for carrier-current equipment

The coupling capacitor is connected to one phase of the high-voltage line on the line side of the line-trap unit. A protective gap and grounding switch is mounted on the base of the capacitor stack. The lead-in from the coupling capacitor is connected to the output tuning coil and output transformer in the outdoor cabinet, through a fused cutout or fused disconnecting switch. The drain coil is located inside of the cabinet and is connected to the lead-in ahead of the fused cutout or fused disconnecting switch.

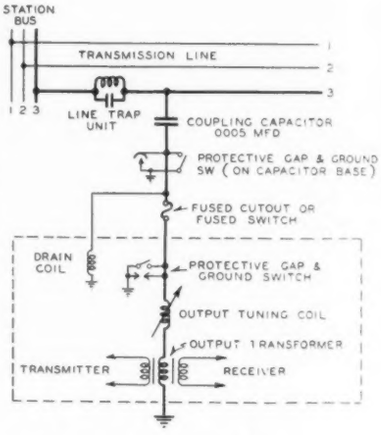


Fig. 4—Phase-ground coupling

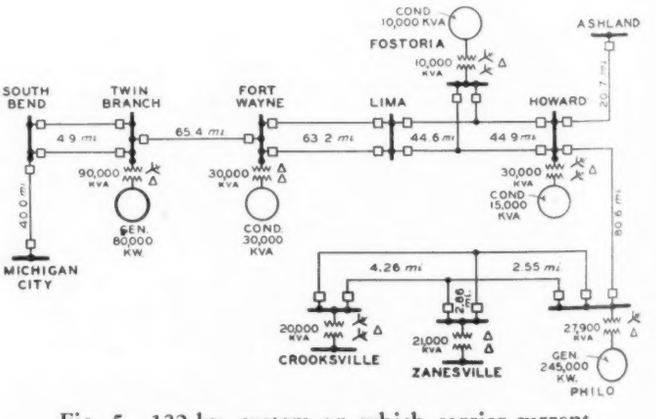


Fig. 5—132-kv. system on which carrier-current relaying was applied

This system consists of a 299-mile, 132-kv. tie line between Philo station of the Ohio Power Company and Twin Branch station of the Indiana & Michigan Electric Company with three intermediate sectionalizing stations and one tap-off sectionalizing station. At Howard station there is a 132-kv. interconnection with the Ohio Public Service Company via the Howard-Ashland line. At South Bend station there is a 132-kv. interconnection with the Northern Indiana Public Service Company via the South Bend, Michigan City line. The 132-kv. system is solidly grounded at Philo, Howard, Fostoria and Twin Branch stations.

of carrier-current relaying was developed which would trip both oil circuit breakers at Philo station practically instantaneously only when a fault involving both 132-kv. circuits occurred.

Inter-circuit coupling was employed at all three stations, thus requiring only one transmitter at Crooksville and Zanesvile stations and one receiver at Philo station. At Zanesville and Crooksville stations the control of carrier-current transmission is governed by a three-phase percentage-current balanced relay similar to the General Electric Company's type RDD relay. The operating coils of this relay are connected in all three phases of the cross-connected current transformers on both circuits and the three restraining coils are connected in series in the residual circuits from the three operating coils to ground. The characteristics of this relay are such that when the current in any one operating coil is 80 per cent, or greater than the current in its corresponding restraining coil, the relay contacts will close to start the transmitter. Current-balanced relays were employed instead of directional-power relays, since no generation is available at Crooksville or Zanesville stations, and in case of two-line trouble involving different phases a directional-power relay will operate incorrectly at these stations to transmit carrier and cause blocking at Philo just when it is necessary for the breakers at Philo to trip.

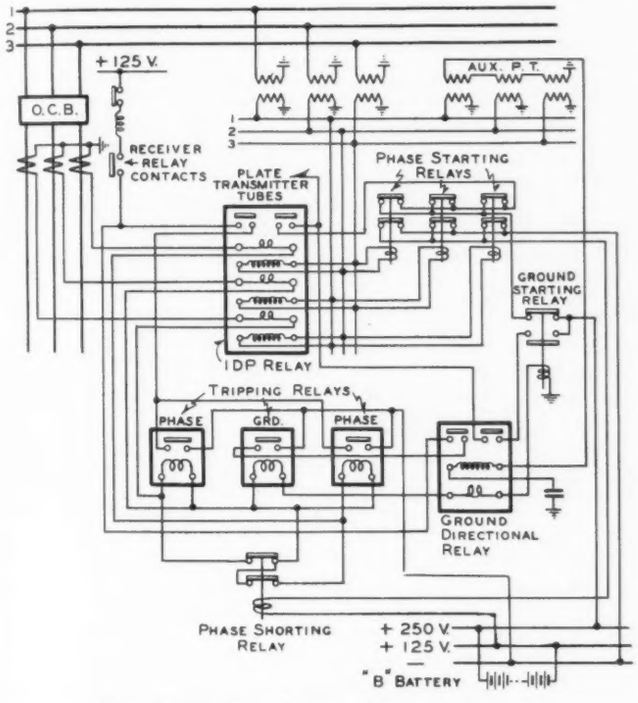


Fig. 6—Undervoltage relays start carrier and tripping relays

In case of a phase-to-phase fault the instantaneous under-voltage-phase-starting relays operate at both stations. One set of contacts on the under-voltage relays energize the phase-shorting relays which remove the short circuits from the current coils of the phase-tripping relays which then start to close their contacts at both stations. The other set of contacts on the undervoltage relays, connected in series with the starting contacts of the IDP directional relay, apply plate voltage to the transmitter tubes at that station where the power flow is from the line into the bus causing carrier to be transmitted.

For an external fault at the station where the power flow is from the line into the bus, the tripping circuit is opened up by both the local receiver relay and tripping contacts of the IDP directional relay and carrier is transmitted. At the other station the power flow is of necessity from the bus into the line and the starting contacts of the directional relay remain open, thus not permitting the transmitter to operate. Carrier will be received by the receiver relay which will open up the trip circuit at this station.

In case of an internal fault the power flow at both stations will be from the bus into the line, hence the starting contacts of both directional relays will remain open and the transmitters will be inoperative. Therefore, the tripping relays at both stations will close their contacts and trip their respective circuit breakers.

In case of a phase-to-ground fault the instantaneous ground starting relay operates, which removes the control of carrier transmission from the phase relays and applies it to the instantaneous ground-directional relay. The operation for internal and external ground faults is exactly similar to that for phase faults except that the ground relays have full control over the phase relays.

At Philo station three carrier-current tripping relays, two for phase protection and the third for ground protection, are installed on each circuit. The contacts of both sets of tripping relays are connected in series, thence through the receiver relay contacts to the coil of an auxiliary relay whose contacts trip both breakers. The contacts of both sets of tripping relays are connected in series, so that for a single-line fault near Philo bus when insufficient current will flow through the circuits at Zanesville or Crooksville to operate the current-balanced relays both breakers at Philo will not trip due to one set of tripping relays at Philo being open. The phase-tripping relays at Philo are set to pick up at a current slightly greater than the current obtained for a three-phase short circuit at Zanesville and Crooksville low-tension busbars, and the ground tripping relay is set slightly greater than the ground current obtained from Philo in case of a ground fault occurring on the low-tension bus at Crooksville station.

In case of a fault occurring on one of the two 132-kv. circuits, the current in the operating coils of the current-balanced relays at either Zanesville or Crooksville will be greater than the current in the restraining coils, hence the relays will close their contacts to transmit carrier which will operate the receiver relays at Philo and prevent both breakers at Philo from tripping. In case a fault occurs on only one circuit near Philo bus, although insufficient current is obtained at Zanesvile or Crooksville to operate the current-balanced relays, insufficient current will flow on the other circuit at Philo to operate its set of tripping relays, thereby preventing both breakers at Philo from tripping. In case of trouble in the transformer banks at Zanesville or Crooksville both breakers at Philo will trip, but this is not considered serious due to the infrequency of its occurrence. In case of trouble occurring on the low-tension side of the transformer banks at either Zanesville or Philo, both breakers at Philo will not trip since pick-up current of the tripping relays will not be obtained. In case simultaneous trouble involving both circuits occurs the currents in the operating coils of the current-balanced relays at Crooksville and Zanesville stations will be less than 80 per cent of the current in the corresponding restraining coils, hence the relays will not operate, hence no transmission of carrier and both breakers at Philo will trip.

The foregoing details have been given to show the extreme flexibility necessary to make carrier universally applicable and illustrate the progress actually made in developing that flexibility.

The carrier-current relaying for the two Fort Wayne-Lima circuits was put in operation on June 7, 1933, and its performance since has been highly satisfactory. There have been experienced twelve cases of external faults, six of which occurred on the Twin Branch-Fort Wayne line, four on the Lima-Fostoria-Howard lines and two

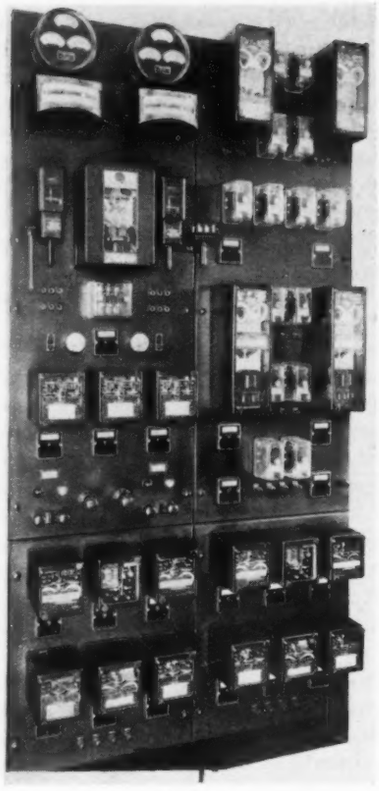


Fig. 7 — Panel layout for two 132-kv. circuits

These two panels embrace all the relays used for carrier-current relaying as well as the back-up protective relays, relay-testing devices, indicating instruments and control switches for two 132-kv. circuits at Lima station. The back-up scheme consists of balanced-power directional protection, instantaneous-phase and ground - overcurrent protection and time-delay separate-reverse power protection for ground and phase faults on each circuit. The type IDP directional relays are utilized both for the carrier-current relaying and for the separate reverse power protection. Triplex ammeters and indicating wattmeters are installed on each circuit.

on the 132-kv. circuits radiating out from Fort Wayne station to Marion and Muncie. In every instance carrier current was transmitted and received preventing the oil circuit breakers from tripping on these two circuits. Two cases of single-line faults have occurred on these lines and in both instances the faulty line has cleared at both ends from the carrier-current tripping relays. One case of simultaneous faults involving both circuits was experienced and the two lines tripped at both ends from the carrier-current tripping relays.

One case of system instability occurred and both Fort Wayne breakers at Lima tripped from the phase-carrier-current-tripping relays opening up the tie line between Philo and Twin branch. Upon investigation it was found that the voltage dropped sufficiently at Lima to cut the phase-tripping relays in service, whereas the voltage at Fort Wayne did not drop sufficiently to operate the starting relays so that no carrier was transmitted at Fort Wayne to block the tripping relays at Lima. This condition has since been remedied by changing the settings of the phase-starting relays at Fort Wayne and Lima to 80 and 60 volts drop-out respectively in place of the previous setting of 90 volts employed at both stations. Since this change was made we have experienced two similar cases of system instability, but no trip-outs occurred from the carrier-current relays, proving the effectiveness of the changes introduced.

The carrier-current relaying for the two Lima-Fostoria-Howard circuits was put in operation on August 5 and the operation since then has been very good. There have been experienced two cases of external faults involving the Lima-Fort Wayne lines and one case of an internal fault, the carrier-current relaying performing correctly in each instance. For the internal fault the records show that all three breakers at the three stations tripped simultaneously and that no cascading of breaker trip-outs occurred.

The results of previous tests heretofore described, the subsequent development work, tests and operating experience described here have definitely demonstrated that the system of carrier-current protection as now developed is both simple and rugged and will furnish universal and fast protection on the simplest line or the most complicated network. Further, by simplification and refinement it has become possible to incorporate the protection scheme as part of the standard switchboard. This, in turn, has resulted in such lowered costs that from an economic standpoint it has become possible to apply such protection to, and justify it on, almost any high-voltage line that is really functioning. In short, carrier-current protection has become a fully practical engineering development with a wide possible field of application.

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Removing Scale from Turbine Blades

Scaling of turbine blades has presented quite a problem on units operating at high pressures and particularly with bad feedwater conditions. At certain temperatures, roughly between 400 and 600 deg. F., some of the salt components (notably Na_3SO_4) carried out of the boiler with the steam become sticky and attach themselves to the blading. The process is cumulative and will continue, if unchecked, until the blade path is completely filled up. In one instance a 15,000-kw. back-pressure turbine lost 1,500 kw. of maximum capacity per week due to this cause. This occurrence is most severe where the condensate is not returned to the boilers and the concentration therein is fairly high. Feedwater treatment becomes a real problem because there are limits beyond which purity cannot be carried.

Up to the present time it has not been found practicable to eliminate scaling by improvement of the steam evaporation system, says C. R. Soderberg*. It is still necessary to find satisfactory methods for removing scales on turbines. The first requisite, he declares, is to treat the feedwater so any scales formed are soluble in water. They may be removed as follows:

Gradually lower the temperature of the steam by injecting water into the steam pipe a considerable distance ahead of the turbine. Great care must be exercised, particularly with high-temperature installations. The water should be admitted through a nozzle which will give a finely diffused spray and careful records must be kept of the temperature.

The washing process undoubtedly imposes a severe strain on the turbine, but experience has shown the method to be feasible when conducted in the right manner, declares Mr. Soderberg.

Corrosion of the blading and other parts is inevitable if a heavily scaled turbine is left standing still a considerable part of the time. A very satisfactory solution of the problem is to circulate heated air through an idle turbine to keep the deposits dry. The otherwise excellent 12 per cent chromium-type stainless steel is not impervious to the effects of ordinary salt which is invariably present in the deposits.

**Manager turbine apparatus division, Westinghouse Electric & Manufacturing Company.*

Engineers' Council Acts

Specifies qualifications for engineers.
Proposes to accredit engineering schools.
Selection and guidance of students suggested.
Changes in membership of societies suggested.

FAR-REACHING recommendations dealing with a program for accrediting engineering schools, the establishment of a policy for professional recognition of the engineer, including a minimum definition of the engineer, and a suggested scheme of uniform grades of membership in the professional societies were agreed upon at the first annual meeting of the Engineers' Council for Professional Development, held in New York October 10, 1933. Other matters of importance at the present time relating to questions of engineering education and engineering practice were presented at the business session held in the Engineering Societies Building. This was followed by a dinner at the Engineers' Club, addressed by Dr. Franklin J. Keller, Director of the National Occupational Conference, attended by members of the boards and important committees of the seven bodies participating in the work of E.C.P.D., as the new body elects to be designated.

This new agency of the engineering profession was brought into being in October, 1932, by joint authorization of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, the Society for the Promotion of Engineering Education and the National Council of State Boards of Engineering Examiners. Its purpose is the enhancement of the professional status of the engineer. To this end it aims to co-ordinate and promote efforts and aspirations directed toward the higher professional standards of education and practice, greater solidarity of the profession and greater effectiveness in dealing with technical, social and economic problems. Its immediate object is the development of a system whereby the progress of the young engineer toward professional standing can be recognized by the public, by the profession and by the man himself, through the development of technical and other qualifications which will enable him to meet minimum professional standards.

E.C.P.D. is made up of three representatives of each of the participating bodies. During the past year the work has been carried on under the leadership of C. F. Hirshfeld, a representative of the A.S.M.E., as chairman pro tem. Dr. Hirshfeld presided at the meetings of E.C.P.D.

E.C.P.D. functions by studying questions within the range of its functions, making reports and recommendations to the participating bodies. It administers only the procedures approved by the participating bodies and by them definitely assigned to E.C.P.D. Four standing committees of E.C.P.D. deal with four chronological subdivisions of the general function of E.C.P.D. The first committee, on student selection and guidance, deals with matters relating to the prospective engineering student up to the time of his entry into the engineering school. The second committee, that on engineering schools, serves to bring about co-operation between the engineering profession and engineering schools during the formal educational process. The third committee, that of professional training, is concerned with plans for the further professional and personal development of young engineering graduates and also of those without formal scholastic training. The final committee, that of professional recognition, has the duty of developing methods whereby those engineers who have met suitable standards may receive corresponding professional recognition.

Student selection and guidance

The report of the committee on student selection and guidance was presented by Dean R. L. Sackett, chairman. This committee had analyzed the literature for guidance of prospective engineering students and submitted some constructive suggestions, which included the need for stressing the breadth of engineering and reducing emphasis on its technical subdivisions and of preparing a concise, understandable description of the work of engineers. Further work of the committee will embody studies of vocational guidance by local engineering groups, prefreshmen camps and aptitude testing. Co-operation with the National Occupational Council, the Boy Scouts of America and other agencies that are concerned with vocational guidance will be developed.

The significant recommendation of this committee, approved by E.C.P.D., was that the objective of the committee be broadened to include aptitudes which contribute to success in engineering education regardless of the subsequent career of the graduate. This supported the view that an engineering education is excellent preparation for life as well as for the activities and responsibilities of the engineer.

Engineering schools

The report of the committee on engineering schools, prepared under the chairmanship of Dr. Karl T. Compton, was presented by Prof. H. P. Hammond. The committee pointed out that the accrediting of engineering schools is being carried on by several agencies between which there is little co-ordination, and that no representative of an authoritative body accredits engineering schools and recommended that it should be a proper function of E.C.P.D. to compose a list of institutions which, after careful investigation, are found to be prepared adequately to offer sound and comprehensive instruction in the various major engineering curricula. Accordingly, E.C.P.D. voted to recommend to the participating bodies that E.C.P.D. be set up as an accrediting agency for schools of engineering. The basic for accrediting engi-

neering colleges recommended by this committee and approved by E.C.P.D. included the following provisions:

Accrediting is to be applied only to those curricula, graduate and undergraduate, which lead to degrees; curricula are to be accredited on the basis of both qualitative and quantitative criteria, the qualitative being evaluated by inspection visits and the quantitative by data secured from catalogs, publications and questionnaires. The methods of providing funds for carrying on this procedure are to be established before this recommendation is forwarded to the participating bodies.

Professional training and recognition

The report of the committee on professional training, presented by Chairman Robert I. Rees, revealed substantial progress. It has made a survey of a group of junior members of engineering societies to determine suitable and desired assistance that may be rendered to young engineers in planning their self-development. A preliminary form of personal analysis blank has been prepared to assist the individual in making a program for his future development. The committee has made substantial progress in preparing a program of education and training to meet requirements for recognition that will be set by the committee on recognition.

The report of the committee on professional recognition, prepared under the chairmanship of Conrad N. Lauer, was presented by Dean J. W. Barker. E.C.P.D. adopted the following policy recommended by the committee as a guide in fulfilling the committee's purpose:

The profession should establish as the goal of attainment a series of qualifications for which the young man, whether graduate or non-graduate, may successfully strive continuously from the time he enters upon an engineering career. This goal of attainment, embodied in a certificate, equivalent to the professional degree and having a value recognizable as adequate to entitle the holder to licensing or registration in a state, should be based upon the following features:

(a) Certification should be earned, and not granted as a mark of honor.

(b) The code of educational qualifications should be more advanced than graduation from college, yet attainable by both college and non-college men.

(c) The attainments should be tested individually by examination (written and oral) or the equivalent and not gaged by personal estimates and testimonials alone.

(d) Educational qualifications should comprise scientific, technical, economic and civic knowledge of a mature order.

(e) The code of experience qualifications should normally make the age of certification fall between 25 and 30.

(f) The ultimate certification into the profession should be the objective to which both the colleges and the professional societies should exert their influence. To this end the colleges should be encouraged to aid by granting the professional degree to those who have been thus certified.

(g) The certificate into the profession should be the means by which the state registration boards would with confidence recognize those essentials which they observe as requisite for the registration of engineers.

(h) And, similarly, the certificate into the profession should be *prima facie* evidence of technical proficiency for admission into the corporate membership of the societies.

By such a progressive educational program involving selection of proper material, its supervised education, intimate contact with the profession during the apprenticeship stage and the attainment of definite specified educational requirements with concurrent recognition by professional societies, educational institutions and state laws, it is believed that an identity would be attained by which those who have not developed experience and maturity of engineering judgment would be recognized as assistants in the engineering field and those who have attained engineering maturity would have an identity universally recognized by the profession itself and the public at large. It is believed that this definition of the engineering profession will be of immeasurable benefit.

E.C.P.D. also approved the following minimum definition of an engineer recommended by the committee and voted to request the adoption of this definition by the participating bodies.

The minimum qualifications for an engineer are:

(a) Graduation from an approved course in engineering of four years or more in an approved school or college; a specific record of an additional four years or more of active practice in engineering work of a character satisfactory to the examining body (the examining body, in its discretion, may give credit for graduate study in counting years of active practice), and the successful passing of a written and oral examination covering technical, economic and cultural subjects and designed to establish the applicant's ability to be placed in responsible charge of engineering work and to render him a valuable member of society,

or alternatively

(b) Eight years or more of active practice in engineering work of a character satisfactory to the examining body and the passing of written and oral examinations designed to show knowledge and skill approximating that attained through graduation from an approved engineering course and also examinations written and oral covering technical, economic and cultural subjects designed to establish the applicant's ability to be placed in responsible charge of engineering work and to render him a valuable member of society.

In accord with the view that the grades of membership in the various societies should have reasonable conformity with this minimum standard, the committee presented the following designations and minimum specifications which were approved by E.C.P.D. for recommendation to the participating bodies for adoption with the stipulation that they are not intended to exclude the affiliation of other persons with any constitutent society in a capacity other than the grades of membership indicated below:

Student Member—A person matriculated in an approved school or pursuing studies in accord with the program of the committee on professional training.

Junior Member—A graduate of an approved school or one who has passed equivalent written and oral examinations.

Member—The full-fledged engineer who has passed the requirements in the minimum definition of an engineer.

Permanent officers were elected consisting of the following members of the executive committee: J. Vipond Davies, A.S.C.E.; Donald F. Irvin, A.I.M.E.; William E. Wickenden, A.S.M.E.; Charles F. Scott, A.I.E.E.; H. C. Parmelee, A.I.Ch.E.; Robert I. Rees, S.P.E.E.; David B. Steinman, N.C.S.B.E.E. C. F. Hirshfeld was elected chairman and C. E. Davies secretary.

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Swapping Industries

A great deal of effort has been spent by industrial development departments all over the country to persuade industries to move from one community to another, but I firmly believe that the greatest results will come from efforts directed toward the retention and sound expansion of industries already operating in their communities.

H. C. THUERK,
Utility Management Corporation.

August Central Station Revenue Above Last Year's

Gradually more favorable tendencies are being revealed in reports of central station income. August revenue, estimated for the whole industry as $154,930,000, very slightly exceeded that of July, and the margin over 1932 increased to 2 per cent, compared with 1.6 per cent in the preceding month. Thus, for the second time there was an advance compared with the year before, after the uninterrupted series of losses that began in November, 1930. Operating expenses, $66,420,000, rose somewhat over July, but were virtually equal to the revised total for August, 1932.

Contrasted with the notable advance in energy output during the past few months, bringing the August figure up to 7,172,000,000 kw.-hr., and so 13.4 per cent greater than a year ago, the change in financial returns was exceedingly modest. With increments of energy sales concentrated chiefly in the low-priced wholesale category and rates being steadily reduced, growth of revenue has by no means been commensurate with energy production.

As in July, about 37 per cent of the energy came from water power. Production from this source was 11.5 per cent larger than a year ago, against 4.2 per cent in July, and the increase from fuel 14.3 per cent, against 21.7 per cent in July. More abundant stream-flow evidently enabled a saving to be made in fuel consumption. In view of the negligible change in operating and maintenance expenses from 1932 the cost of the larger output was apparently balanced by savings elsewhere.

New England again heads the list in percentage increase in revenue over last year, followed this time by the South Atlantic region. Gains in the Middle Atlantic were larger, and in the East North Central smaller than in July, both now being close to the nation-wide average.

On the whole, the industrial areas show up rather better than the others. The fact that only three are still under last year's level, whereas so recently as May there was not a single plus sign in the revenue column of Table II, is certainly indicative of improvement. In two of these three the disparities are small. The West South Central is the only one that is seriously lagging. Conditions in the oil industry may account for this, just as activity in metals mining probably explains the sustained rise of energy in the Mountain States, unfortunately not reflected in the revenue figures.

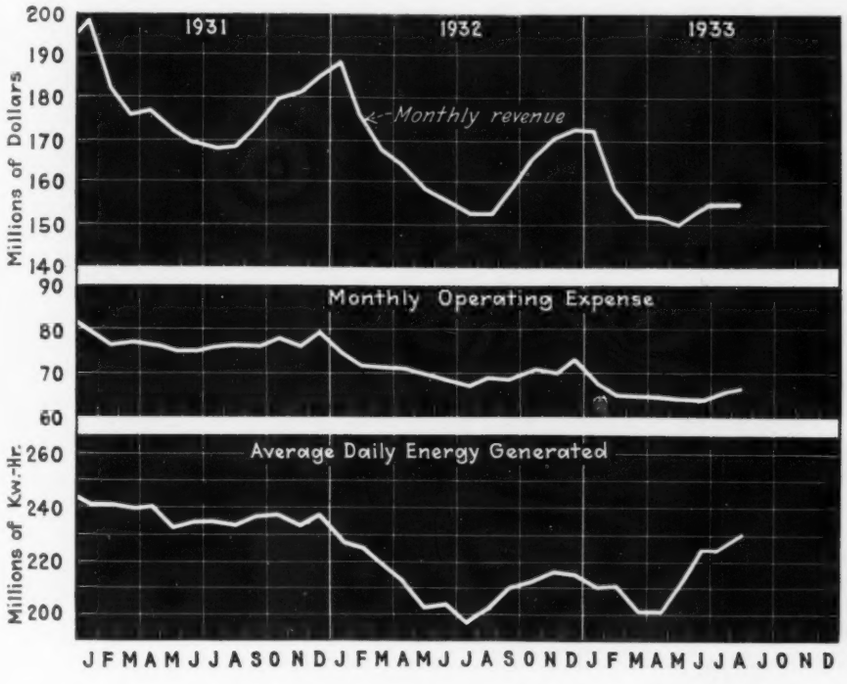

Table I—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1933	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
May	6,577,167	+ 5.3	3,223,173	+13.3	3,353,994	— 0.8	1,709,000	+ 2.4
June	6,791,783	+10.5	2,826,525	+12.7	3,965,258	+ 8.9	1,739,000	+ 7.5
July	7,011,815	+14.5	2,612,192	+ 4.2	4,399,623	+21.7	1,922,000	+12.1
August	7,172,103	+13.4	2,668,881	+11.5	4,503,222	+14.3	1,982,000	+ 7.8

Table II—Regional Revenue, Energy Output in August, 1933

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	154,930	+ 2.0	7,172,103	+13.4	2,668,881	+11.5	4,503,222	+14.3
New England	16,510	+ 4.3	522,184	+25.2	174,867	+ 1.3	347,317	+42.0
Middle Atlantic	39,500	+ 2.6	1,771,577	+11.0	458,174	+15.1	1,313,403	+ 9.3
East North Central	35,680	+ 2.3	1,646,766	+18.7	91,514	—18.5	1,555,252	+22.0
West North Central	13,080	— 0.4	454,536	+ 2.0	91,668	—10.8	362,868	+ 5.7
South Atlantic	17,770	+ 4.2	844,042	+25.0	460,642	+42.0	383,400	+ 9.3
East South Central	5,000	— 0.4	291,348	+ 2.4	242,448	+ 2.3	48,900	+ 3.3
West South Central	8,240	— 3.6	375,660	— 0.4	5,215	—45.5	370,445	+ 0.7
Mountain	3,680	+ 0.5	251,135	+24.1	209,839	+30.0	41,296	+ 0.5
Pacific	15,470	+ 0.6	1,014,855	+ 7.5	934,514	+ 6.9	80,341	+14.2

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Table III—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

Month	Total Gross Revenue from Sale of Energy*		Total Operating and Maintenance Expense†	
	1933 Thousands	Per Cent Inc.	1933 Thousands	Per Cent Inc.
May	$149,950	— 5.3	$63,420	— 4.5
June	153,590	— 0.9	64,870	— 2.0
July	154,860	+ 1.6	65,590	— 0.1
August	154,930	+ 2.0	66,420	+ 0.8

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.

†Does not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions.

Stamping Out Cord Menace

"Experience has shown that poor cords are responsible for a greater amount of dissatisfaction with electrical apparatus and electric service generally than any other cause," pointed out J. A. Smith, executive director Electrical Cord Manufacturers Division of N.E.M.A., speaking recently before the New Jersey Council of Electrical Leagues. "Appliances equipped with unserviceable cords," he continued, "are frequently relegated to the shelf and often remain there for long periods." As a result energy revenue is lost to the utility; frequently otherwise first-class equipment is condemned by the user, and dissatisfaction with all electrical equipment is likely to be engendered.

Furthermore, 20-60 per cent of the service or trouble calls made by utilities are due to poor cords. In one case involving 3,200 contacts, made during a house-to-house survey, it was found that 19 out of 25 cords were

GET penny WISE
Look what conveniences you can get from your electric outlet for a penny . .
if the cord is good*
*Good cords on your lamps and appliances are identified by this label . . .
brings your temperature down to normal with an electric fan for a whole de-simmering evening.
puts that schoolgirl complexion on a dejected and wrinkled gown with an electric iron.
gives you a breakfastful of golden toast from an electric toaster for the largest and hungriest family.
gives your floors such table-top cleanliness with a vacuum cleaner that you can eat off 'em.
keeps your good food and liquids respectable for five solid hours in an electric refrigerator.
heats the batter for cake and whips the mayonnaise or what have you with an electric mixer.
And scores of other services that grow smiles where frowns once flourished
KEYSTONE
PUBLIC SERVICE CO.
These approved cords help you get better and longer service from your favorite appliances. When you purchase your next appliance or cord play safe and insist on labelled cord. The guarantee of satisfaction and durability.

Utility advertisement appearing in three newspapers in Oil City, Pa.

This was an 8 x 8-in. advertisement.

defective. When service calls cost 75 cents to $3 apiece, they accumulate into a large item of expense which can be reduced only by eliminating the cause.

Accounting for this situation, Mr. Smith said: "Between 1923 and 1932 the greater part of the flexible cord sold was of the unapproved type. In 1930 it was estimated that 85 per cent of the cord sold was unapproved. The reason was that it was difficult for the uninitiated to distinguish between questionable cord and the standard regularly approved cord. It was an easy matter for an unscrupulous maker of portable appliances or lamps to equip his product with unapproved cord."

A remedy has been provided, in the form of bracelet-like Underwriters' labels* applied to cord at 5-ft. intervals, by which the public can readily identify approved cord. Its advantages have been and are being publicized through various national magazines and newspapers. Electrical inspectors, electric leagues, trade associations, utilities, dealers and manufacturers are co-operating to stamp out the cord menace. Inspectors throughout the country already report there is an increase in the sale of approved cord.

"The effectiveness of the movement in a community," warns Mr. Smith, "will be almost directly proportional to the activity of those in a position to promote it. Since the more profitable income of a utility company depends on the maximum use of every convenience outlet it should be eager to encourage the movement." Opportunities exist through the public contacts made by home-service bureaus and sales, meter, service and advertising departments. Purchasing departments can insist that approved cord be supplied with all appliances for resale. Co-operation with inspection authorities to eliminate unapproved and poorly made electrical equipment and materials, stimulation of electrical interests to sponsor bracelet-labeled cord as a business-building movement and institution of cord surveys among customers were recommended by Mr. Smith.

Some utilities have contacted dealers and department stores in their territory to get them to insist on labeled cord. Many companies have distributed booklets throughout their systems with the same idea in mind. Some utilities have purchased advertising space in newspapers to call the advantages of labeled cord to the general public. Extension of public insistence for apparatus equipped with labeled cords is expected to reduce electrical hazards, increase continuity of service and decrease servicing costs.

Yellow label cord is primarily for lamps; blue label for table appliances or other heating equipment whose cord is subjected to comparatively little bending; red label for electric irons and similar heating appliances where cord is subjected to considerable flexing; gold label is for electric-heat appliances where exceptionally long-life cord is desirable.

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Rapid Sulphation Attributed to Antimony

Recent experiments at the Bureau of Standards (as reported in Research Paper RP567) have shown that the corrosion of positive grids during normal operation of storage batteries may liberate enough antimony to affect the performance and the life of the negative plates. Loss of charge on standing for 114 days was found to be higher in those cells which had the higher percentages of antimony in the grid alloy. It was the negative plates which limited the capacity and the effect was attributed to the measurable quantities of antimony in the active material after 115 cycles of charge and discharge. The percentage here was higher in those cells whose positive grids contained the greater percentages of antimony. The plates having the greatest amount of antimony in the active material were the ones which sulphated most rapidly. The negative plates from cells whose positive grids were made of pure lead or the lead-cadmium alloys sulphated less than the others. Positive grids of lead-cadmium alloys did not, however, prove to be as durable as the lead-antimony alloys in the experiments.

Trial Ranges Expedite Acceptance of Electric Cooking

By RALPH D. CUTLER*
Vice-President Hartford Electric Light Company

The Hartford range plan is not primarily a rental plan, although unfortunately it has been so called. It is a scheme for putting electric cooking on trial, and obtaining rapidly, under adverse conditions, a broad acceptance of the idea of electric cooking, thus opening a wide market for the profitable selling of permanent ranges by dealers. The results in eight months show twice as many ranges added as were sold in the previous best twelve months. Dealers have obtained 20 per cent of their sales through use of trials, thereby keeping their sales within 8 per cent of 1932, while the U. S. average is minus 38 per cent. Dealers' sales profits are supplemented by trial fees; contractors' wiring sales increased fourfold and the territory has absorbed ranges sixteen times as fast as the country average.

WE HAVE long wanted our share of the cooking business, and we were sick of the extreme costs of trying to get it in homeopathic doses. We had tried about every American selling plan, including dealer selling, active sales crews, free wiring installations, trade-in allowances, ample advertising, cooking classes, special campaigns, etc., backed up by favorable rates of 3 cents or less. It costs us around $150, all told, to obtain each new range customer. One nationally known range manufacturer had tried an intensive year's campaign, with no greater sales volume. And we understand his average selling cost was about 10 per cent higher than ours.

After years of effort, by 1931 we were cooking for only about 5 per cent of our domestic customers.† This was about as good a showing as in any of the neighboring properties in New England and was nearly the national average (6.9 per cent). But never, in our best years, had we installed ranges as fast as new homes were being built, so we were constantly losing on our market. We were getting a bit weary, but, in line with the national trend for 1932, we embarked on a definite program of building up selling by dealers.

Most of the best merchant outlets in the territory were displaying electric ranges, hoping for, and trying for, this business. We agreed to team up with them for another try. It was this committal which prevented our trying out a rental plan in 1932, in spite of telegraphic urging from our absent chief to proceed with rentals. We could not then see how we could fit renting into the dealer plant. This delay was fortunate, because the dealer-selling plan had a thorough try-out, with, however, only indifferent results, and in the interval the important change from the rental idea to the "trial range" plan was conceived.

Our situation—for 1933

At the beginning of this year we, in common with many electric companies, were faced with:

1. Reduced business, both gross and net.
2. Therefore, excess plant capacity.
3. Ample bank balances, earning small return.
4. No new construction requirements on which to spend these balances.

Obviously, what we needed was new gross income, without corresponding increase in expense. How could available funds be used to accomplish this? What other field than the domestic offered any chance?

It was thought out this way:

(a) Range services, to the meter board, as well as ranges, are capital expenditures.

(b) A range and outside service connection, requiring an investment of about $80, would yield annual gross revenue at 3 cents per kilowatt-hour of over $40.

(c) Since excess plant capacity was available, for the immediate future an abnormally large part of that new gross would be new net, even after defraying selling expense and energy fuel.

In short, reduce selling expense by liberal capital expenditure and obtain fullest possible benefit to this year's net thereby, at a time when each dollar of net is so badly needed. Also, in common with all American companies, we sense the importance of lower average prices. We believe the way to avoid lower *maximum* rates is to broaden the use at *increment* prices. A big range business will do this.

In using rental in other countries the dealer problem has not been greatly considered; the companies have not hesitated to use a permanent rental plan. But in our case with ranges there is a very definite problem, through the presence of many dealers trying hard to sell ranges, and it has been thought that a permanent rental plan would kill their selling, or their hopes of selling.

Repeatedly, field surveys have shown that our average housewives want to cook electrically some day. But they will not buy. They don't quite dare. Women nearly everywhere have always found it hard to believe the advantages of electric cooking as told by salesmen or saleswomen. Only by a trial, or by a friend's "say-so" from experience, can women in numbers believe the advantages of this fuel or be sure of its economies. There aren't enough women in our territory with experience to give the "say-so." But by trying a range first, with no obligation to keep it, we thought that women could convince themselves of these advantages in their own

*Based on presentation before Association of Edison Illuminating Companies.

†Territory covers 58,000 domestic meters, nine-tenths city business, with good competitive gas service available at prices from 75 cents to $1.

kitchens, and they could then, when ready, purchase through dealer channels the exact size, shape and color of electric range which would suit their choice for permanent ownership.

The fundamentals of this "trial range" plan are best expressed in Samuel Ferguson's original memorandum as follows:

1. Our experience in selling ranges over a period of years shows the selling expense to be about $150 per range.
2. It is obvious that no dealer can work against this cost on the spread given by the manufacturer.
3. In effect, we have been asking the dealers (and ourselves) to do three jobs for the $50-$60 spread:
   (a) Sell the idea of electric cooking.
   (b) Sell the house wiring.
   (c) Sell the range.
4. With the idea and the wiring eliminated, the spread should be sufficient for the dealer to sell the range.
5. We will offer a commission to him to get over the wiring obstacle.
6. We hope we will sell the idea of cooking by a trial offer.
7. Then we look to a greater rather than a lesser sale of ranges, as our plans all contemplate and make easy the substitution of a sold range of proper size, color, etc., for the single type which we offer for trial, but not for sale.
8. Whether we succeed or fail in creating a range market, we cannot tell, but the fact is certain that there is no market of any magnitude at present.

In short, both ourselves and the dealers will tell the public, "If you don't believe, enough to buy, try it first, with no committal or investment. After you believe our claims for speed, economy, convenience, etc., buy any range that suits your choice." The company will thus furnish the powder to blast the way open to a wide customer acceptance. After enough thousands of housewives believe in electric cooking it should certainly be possible for dealers to sell their bigger or prettier ranges, particularly under normal business conditions of customer-spending power.

Employee experiment

We tried the plan first "on the family"—our employees. Here we had a cross-section of the community, particularly favorable toward electricity, who had been for years enjoying rates one-third lower than other customers. As a result of many bargain offers, one-quarter of the employee families were cooking electrically.

On December 12, 1932, a small folder was distributed among employees, offering a trial range at a low fee to employees who would share the wiring costs. The response was immediate. In a week 5 per cent more employees were connected and cooked their Christmas dinners electrically. The installations have increased steadily and half of our employees are now customers for cooking.

A careful analysis of this experiment showed a marked gain in the distribution among renters and among the lower income classes. Neither of these groups had before been anxious to take a plunge to the tune of a hundred dollars or more, without a chance to try the equipment first. But on the new plan more employees adopted electric cooking in two months than had done so in two years prior.

A great deal of thought was put on the choice of the trial range. Obviously we were selecting a tool for repeated use, over a long pull, in considerable quantities. It was felt that the range used must meet the following criteria:

Underneath all the various kinds of rental plans the key thought is—the customer need not at first be committed to an investment. Straight rental postpones forever any customer purchase; rental-purchase postpones, but still implies eventual purchase. As such it builds up certain customer resistance. If the customer were already convinced that she wanted electric cooking permanently, then rental-purchase might have the greater appeal. But such is not yet the case here.

It is therefore essential that every possible resistance to the idea of purchase be removed. That is one reason we avoided any purchase implication, or any term of committal, in developing this "trial" plan. The other reason, fully as important, is that rental-purchase is infinitely more complicated when many makes of ranges and many dealers' interests are involved.

Performance—It must have speed, with reliable oven control, so that complete customer satisfaction with cooking is assured.

Easy to Service—Designed so as to make the repairs of units and switches, and replacement of enamel surfaces and oven linings, as simple as possible.

Design—Sufficiently modern to reduce the hazard of great change of style before reasonable life has been served. However, not too complete; therefore no convenience outlet, separate broiler or timer.

Only One Model—This reduces service costs; makes easier the substitution of other models by dealer sales; simplifies the trial offer in customer's mind, as she does not have to choose between models.

Not Available for Sale—Declining to sell the trial range at any price avoids price comparison; keeps all question of investment out of customer's mind; makes it easier for dealers later to replace by sale of more modern or more beautiful range.

A "Special" Model—By using a special range, not available in a general line, with make not advertised, the utility avoids glorifying any one dealer's general line of ranges to the embarrassment of the lines of other dealers.

Our engineers submitted many suggestions for facility of servicing, all of which were incorporated in a special range, which bears the label "Hartford."

Dealer co-operation

Late in January the plan developed for the presentation to the public was thoroughly gone over with the local dealers. At first they were skeptical of it. They saw that many of their immediate prospects would probably be diverted from buying. But when they looked at the long-term aspects they began to see things differently. They admitted that we were all getting nowhere with the old methods; they agreed that every one had always been in the red in selling ranges; they saw we were sincere in arranging in every way for them to use the trial plan and paying them a commission for trial orders. They knew that some way of getting wide customer acceptance of electricity as a fuel and wiring of a large number of kitchens for its use is necessary to establish the electric range as a profitable merchandising item in our territory.

We agreed to protect their prospects and to avoid selling ranges ourselves. We stated that it was not our intention or desire to ultimately finance all kitchens with these trial ranges. We made it clear that we looked on these trial ranges as a revolving stock of demon-

strators to be used over and over again to convert people to the use of this fuel. We agreed to distribute among them the names of users of trial ranges which we obtained, and in every way to co-operate with them in substituting as soon as possible their sold ranges for our trial ranges. For example, we are now financing their range sales on four-year terms.

This willingness to consider our installations temporary trials, and to remove these gladly to give way to sales, is very important. It is the root of success for the dealer.

After the dealer meeting, every dealer who had been stocking a line of electric ranges was consigned a "Hartford" trial range for display, and urged to place a trial whenever he could not make an immediate sale, as his own prospect for later on.

Likewise, the electrical contractors were told that the wiring would be divided equitably among them at standard prices for the various types of installations. Of course, priority on the job was given to a contractor if he obtained that order, as well as a commission for the trial range order. As a result, a number of contractors who in the past were passive have become active in the range business.

The plan was announced to the public on February 1, coupled to the celebration of our 50th year anniversary. We offered free installation for the first 500 ranges put in, thereby waiving the partial installation charge of $15 previously in effect. This wiring offer covered either trials or dealer sales. The whole idea was "Electric Cooking on Trial," at a fee of 30 cents a week. On the tenth day the "free wiring" book was closed, with 592 applications. By the end of February 382 installations were completed, with every range demonstrated by our home service department. And it should not be overlooked that 30 per cent of the applications had been taken by dealers, as demonstrations to lead toward their sales later, and by contractors who wanted the wiring jobs.

All this new wiring work was divided among nearly 40 contractors, who needed business terribly, and who gladly accepted our standard installation prices worked out through the past year.

During March and April we resumed the $15 installation charge. Progress slowed materially; only 40 orders resulted, which low number we thought was due to the clean-up of prospects which had just been made. But this was not so. People didn't want to pay even that part of the wiring in these times, and the dealer salesmen found it hard going, as did our men. Meanwhile, we were experiencing a few returns, which amounted gradually to 7 per cent of the trial installations, and that lost investment in wiring must be avoided.

Therefore, in May the plan was dressed up in a new spring bonnet. The $15 installation charge remained, but we agreed to rebate it to the customer at the end of two years if an electric range, either a trial or purchase, is then in use. This has prevented idle curiosity from obtaining a wired kitchen, as well as orders placed in the interests of contractors needing work. Because we wanted the maximum speed this year we agreed to waive the fee of 30 cents a week until June 1, 1934. The idea of "Try or Buy," "Buy or Try" has been kept ringing consistently. On this basis, for the past four months the trial installations have averaged about 30 per week. Of course, with this volume our selling costs per range have been greatly reduced.

Results obtained

As natural with a new scheme, reactions have been both negative and positive. Perhaps some people still believe that we want to introduce the exclusive practice of permanently renting ranges in place of customer purchase from dealers, while what we really want is to sell many kilowatt-hours for cooking on a greatly increased number of ranges sold by dealers.

Since the plan has only been operating about seven months it is too early to obtain any final figures, but the following results on the positive side can be stated from figures to September 1:

Added Business—Total installations by years (Hartford only): 1931, 586; 1932, 332; 1933, 1,107 (eight months).

The above 1,107 installations are made up of 978 trials and 129 sales. The total additions represent 2 per cent of the domestic customers, and the range density has now been raised to 7½ per cent. The additions so far in eight months this year have been almost twice those made in the best previous full year.

Reverts—In Hartford the returns from all causes have been 7½ per cent of installations. Three-fourths of these are due to the initial free installation offer. Since requiring a deposit of $15 for installation, only a few installations have been lost out of the last 500 for any reason.

Conversions to Sales—These are commencing, although no landslide of them could be expected so quickly in these times. In Hartford, out of the sales by dealers this year, 20 per cent have been made by converting trials to sales. About as many more sales were first attracted by the trial motive and then changed to purchase from dealer before installation. Thus the total dealer sales here in this year of 1933 are off only 8 per cent from those of last year, whereas for the country as a whole we are told that the sale of ranges in the first half-year dropped off 38 per cent.

Dealer Earnings—The dealers have collected $3,000 in commissions for trial orders, which have supplemented their profits from sales and helped materially to keep their sales organizations going. The contractors have installed about $45,000 of range wiring—as much in half a year as in two whole normal years prior.

Service Costs—Service per range on the trial ranges is running 20 per cent below the service on ranges sold in the same period, both as to costs and calls per range. So far we believe the estimate of $3 per range per year is approximately correct.

Our Share of the Business—We understand that our territory, which comprises under 0.3 of 1 per cent of the country's domestic customers, absorbed 4.5 per cent of the country's range shipments for the first half of the year, a ratio of 16 to 1.

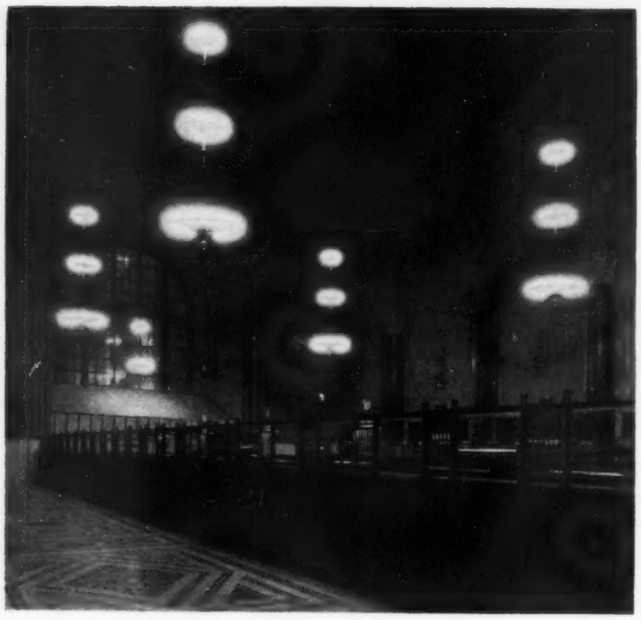
Investment Hazard—The trial fee will repay the bare cost of the range in 3½ years; it covers service and interest if continued in use 5½ years. From the experience in England and Canada we are not worried that the useful life will be less.

The normal revenue at regular rates is, therefore, left to cover operating expenses and carry the plant investment required to serve the range. In this latter connection we find that there is at present considerable fat in the distribution system, as in Hartford only an average of 0.4 kw. of added transformer capacity has been needed to serve each added range. These are days when there is a good deal of net in almost any new dollar of gross. And the trial ranges seem to be yielding the same yearly revenue as sales, something over $40.

This trial method appears to be the fastest way of overcoming customer hesitation. With it we expect to come more quickly and more cheaply to a degree of customer acceptance sufficient to sustain a dealer's selling job. We wish we had started with it years ago.

Economic Comparison of Old and New

By A. L. POWELL
Supervising Engineer Incandescent Lamp Department, General Electric Company.



Old portion of bank

Six ring-type luminaires (E. F. Caldwell & Company); 64 40-watt and twenty 25-watt round all-frosted lamps without auxiliary glassware in each luminaire; illumination, 3 foot-candles; total number of lamps, 504 at $176 list; total wattage, 18,360; floor area, 12,000 sq.ft.; wattage per square foot, 1.5; foot-candles per watt per square foot, 2; lamp expense per 1,000 hours per foot-candle per square foot, 0.63 cent.

The lighting in the new addition to the Bowery Savings Bank, New York City, affords an interesting economic comparison with the old. As shown by the accompanying illustrations and their captions, 8 foot-candle illumination has been obtained from attractive luminaires having uniform brightness with a lamp expense per 1,000 hours per foot-candle per square foot of only 0.19 cent and a wattage per square foot of 3.2. In the older, main-banking portion the average illumination is somewhat under 3 foot-candles. This is obtained with a lamp expense per 1,000 hours per foot-candle per square foot of 0.63 cent and a wattage per square foot of 1.5. The round bulb lamp used in the old fixtures is inherently 8 per cent less efficient than the standard lamp and has a rated life of but 750 rather than 1,000 hours. These factors combine to make the older installation using these lamps more expensive to operate.

It is true that the recent lighting installation uses a relatively large number of rather small lamps. If the fixture had been so designed as to function effectively with a single high-powered lamp, then it would be found that one 750-watt lamp would give almost the same output as the group of smaller lamps now used per fixture. On this basis the total consumption for the room would have been 3,000 watts, or 1.8 watts per square foot. The illumination level would be 7 foot-candles, making the

New annex of bank

Four ornamental semi-indirect luminaires (E. F. Caldwell & Company); four 100-watt and 24 40-watt lamps in each; illumination, 8 foot-candles; total number of lamps, 112 at $24.80 list; total wattage, 5,440; floor area, 1,680 sq.ft.; wattage per square foot, 3.2; foot-candles per watt per square foot, 2.5; lamp expense per 1,000 hours per foot candle per square foot 0.19 cent.

Bank-by-mail department

Dense semi-indirect bowls (Westinghouse-Ainsworth), supported by three chains and chromium-plated stem; spacing, 7½ ft.; one 300-watt inside frosted lamp per luminaire; illumination, 22 foot-candles despite slightly dirty fixtures; socket husk extends over neck of lamp, eliminating this element of brightness; ceilings treated with white acoustic material; walls, light cream; floor, brown linoleum.

foot-candles per watt per square foot 3.9 and the lamp cost per 1,000 hours per foot-candle per square foot 0.13 cent.

These figures are especially interesting when one considers that the new lighting installation is much more pleasing in every respect than the old. Almost every one will agree that the luminaires themselves are more beautiful, there is less glare, fewer contrasts in brightness, a better distribution of illumination and a far more cheerful room. We should never sacrifice any element of appearance for efficiency in the building which is essentially monumental in character, but if it is possible to obtain equally satisfactory or even better results from an esthetic standpoint in a more efficient manner, then common sense certainly indicates this to be most desirable.

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Overcoming Edge Effect in Breakdown Tests

The disturbing effect of the edges of the electrodes in all types of tests of the breakdown strength of materials and apparatus is well known. The concentration of electric flux density on surfaces of short radii of curvature at the edges causes regions of local stress much higher than those between the electrodes. Many remedial and corrective measures have been tried, such as increased specimen thickness at the edges, guard rings, shields, and immersion in semi-conducting liquids. All of these measures are troublesome, in that they require special preparation and construction, and few are susceptible of exact computation and design.

Special interest, therefore, attaches to a new method of eliminating edge effect proposed by A. S. Norcross in a recent number of the *Review of Scientific Instruments*. Briefly, the method consists in maintaining the active test area of the specimen at a higher temperature than that at the edges of the electrode. This is accomplished by embedding the heating element in the test electrode together with thermocouples, so that the temperature may be accurately known. The efficacy of this feature depends on the fact that the breakdown strength of nearly all materials is lowered by an increase of temperature. In this case the test area, being at a higher temperature than the edges, breaks down first, notwithstanding the actually higher stress on the edges. The tests which are reported indicate that for a difference of temperature of from 6 to 9 deg. between the test area and the edges in the case of glass was sufficient to cause all failures to occur in the test area and to indicate a quite satisfactory uniformity of breakdown strength. In the description as published, it is stated that the method is applicable only to those materials whose breakdown strength is lowered by an increase of temperature. There would appear to be no reason, however, why the use of a cooling system would not permit application to materials whose dielectric strength increases with temperature, if there are any such. On the other hand, for any materials which have approximately zero temperature coefficient within the working range, the method would present no advantages. As stated, however, most materials have a negative breakdown temperature coefficient and the principle proposed would appear to offer many advantages.

Welding Structural Nickel Steel

W. L. Warner, Watertown Arsenal, expressed the belief at a recent meeting of the American Welding Society that a general purpose covered electrode could and should be developed which will give complete protection to the metal passing through the arc and leave no slag on the deposited metal. The arcing characteristics should be similar to bare electrodes so the electrode can be similarly handled in any position. When such an electrode makes its appearance, he declares, structural welding, where high impact and vibration are encountered, will have taken a new impetus and designers can leave out a few more gusset plates by increasing allowable design stresses. He also claimed that a suitable alloy steel electrode is needed for welding heavy structural nickel plate to produce sound ductile welds of high strength.

The usual practice at the arsenal in butt welding structural nickel plate is to bevel thicknesses of $\frac{1}{4}$ in. and over at about $37\frac{1}{2}$ deg. with a slight shoulder at the bottom, between $\frac{1}{32}$ and $\frac{1}{16}$ in. On thicknesses of $\frac{1}{4}$ in. and under a $\frac{1}{8}$-in. bare low-carbon electrode with 110-120 amp. is used and these conditions are strictly adhered to. From $\frac{1}{4}$ in. in thickness up to and including $\frac{1}{2}$ in. a $\frac{3}{32}$-in. electrode may be used with a maximum of 150 amp.

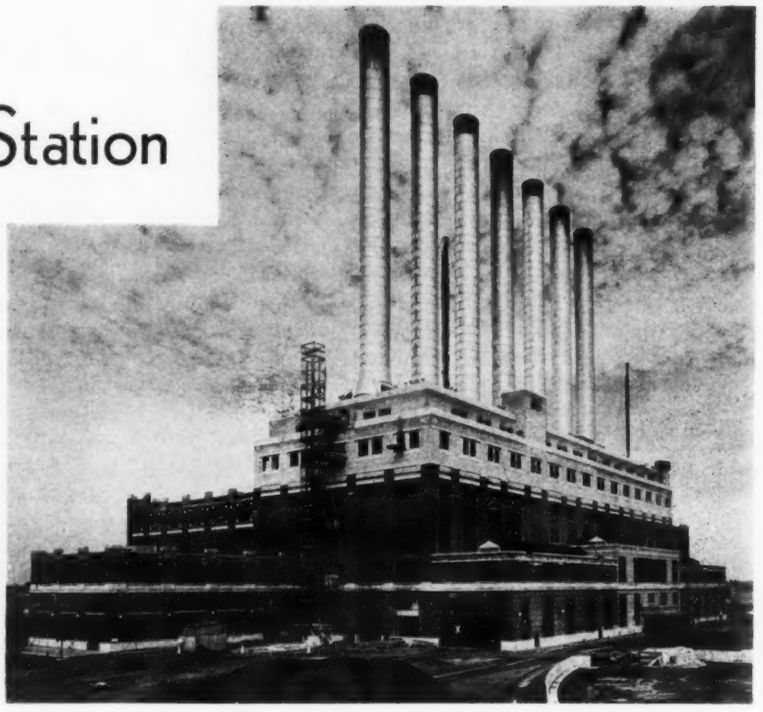
Structural nickel plate butt welds generally show a more porous condition with bare electrode than similar welds on structural carbon steel, and this characteristic becomes more pronounced as the amperage is increased above the limits given. With bare electrode the porosity of the weld metal on nickel steel plate is also sensitive to arc length and rate of travel. A very short arc of, say, 15 or 16 volts will produce a porous metal, even though the current is proper for the size of electrode being used. An arc of 18-20 volts gives best results as to soundness and physical properties. An arc of 20-24 volts with bare electrode will produce a clearer X-ray picture, but the metal is brittle and low in impact.

Weld metal deposited from a covered electrode on structural nickel plate does not show the same sensitivity to current, arc voltage or speed of travel as with the bare electrode. The welder can produce sound welds under any usable welding conditions where he can handle the electrode properly. But on structural work the manipulation of present types of commercial covered electrodes is very exacting and costly because of the heavy slag involved.

From experience at Watertown Arsenal a covered type electrode is essential to develop sound weld metal and good impact strength. Tests with $3\frac{1}{2}$ per cent nickel steel wire covered with several commercial coatings show different effects of these coatings on the nickel steel deposit. Whether a suitable coating should be entirely organic or inorganic, or some combination of both, cannot be definitely stated, Mr. Warner said.

Some experiments have been made at the arsenal with an electrode containing $\frac{1}{4}$ per cent molybdenum and covered with a commercial coating. This electrode gave very sound weld metal and very smooth arcing characteristics. The weld strengths obtained were approximately the same as those obtained with a 2 per cent nickel electrode.

Rehabilitating Connors Creek Station



By P. W. THOMPSON

Chief Engineer of Power Plants
Detroit Edison Company

FOR several years past it has been evident from the estimates of future requirements that additional generating capacity would be needed to supply the load area now being served by Connors Creek. A somewhat longer period of time than might be supposed is required to provide such additional capacity. Two years is about a minimum, with three to five years a more nearly representative figure. For this reason predictions of the requirement are made for about ten years in the future, and are continually being revised in the light of current conditions. It is safe to say that a prediction made for ten years ahead never is correct because of the changing economic conditions, but the continuous revision of such estimates provides a reasonably accurate indication for near future periods.

With the uncertainties of the present facing us, it is even now impossible to tell accurately when to expect an additional load on Connors Creek. However, the indications are that this may, and probably will, come sooner than had been expected, and therefore the first steps in the project of providing the necessary future capacity are under way.

Because of the uncertainty as to when this additional capacity might be required, studies have been carried on for the past four years as to how this might best be provided. Several schemes appeared feasible, and these were given consideration and study.

Obviously, there were two major plans which would produce the desired result. One was to erect a new plant adjacent to the old one on property now available; the other was to rehabilitate the existing old plant by removing equipment rapidly becoming obsolete and replacing it with machinery of modern design having greater reliability and efficiency.

The problem here was somewhat different from the one at Delray, where a new plant was built instead of modernizing the old power houses Nos. 1 and 2. The foundations which had proved reasonably adequate at Delray for the old plants were not of such construction as to accommodate the increased loadings which the new boilers and turbines would have produced. The canals carrying the cooling water to and from the condensers were inadequate and would have required enlarging. The turbine room, which was constructed to accommodate vertical type turbo-generators, would not have provided adequate space for an economical arrangement of large modern machines of the horizontal type. These facts and other considerations which were not subject to engineering analysis led to the conclusion that in the case of Delray a new plant was the correct solution.

Connors Creek power house, which was constructed in 1914 and 1915, was designed for horizontal type turbo-generators and large boilers of the same type as those installed in Delray power house No. 2. The boiler room steel was designed for the later addition of economizers if desired. A more liberal spacing of equipment was adopted, one result of which was the later installation of one and then another 45,000-kw. turbo-generator in a turbine room designed with a width originally chosen for 20,000-kw. units. Although settlements of the foundation have occurred, they are by no means serious, and extensive studies prove that such increased loadings as will result from the new and heavier equipment will not produce unsatisfactory settlement. The entire building and substructure, therefore, are, with some additions and very little alteration, entirely adequate for the installation of modern steam-electric generating equipment. Studies of the economics of building a new plant, versus rehabilitating the old, substantiated the belief that it would be more satisfactory and economical to rehabilitate the old plant.

Steps taken in rehabilitation

As a first step in the program the 24,000-volt switching equipment and control was removed from the power house to Essex station, a new switching station bearing the same relation to the Connors Creek power house that Waterman station does to Delray power house No. 3.

As the design progressed it became apparent that additional height would be needed in the boiler room to provide space for new boilers with their economizers, air preheaters and induced draft fans, and that an increase in the capacity of the overflow canal would be required. It was possible to carry on the work involved in providing these additions without interfering with the operation

of the existing plant, and therefore this first step in the project was begun about two years ago and is now practically complete.

Carrying out a long-established policy to have foundations installed well in advance of the time needed, an addition to the turbine room, including substructure, was made and provides adequate space for a future 90,000-kw. turbo-generator.

In order to proceed further with the design it became necessary to establish definitely the steam conditions; i.e., the pressure and temperature at which the steam is to be supplied to the turbines. After many studies based on estimates of equipment cost and fuel economy to be expected steam pressure of 600 lb. per square inch and temperature of 825 deg. F. was decided upon. This pressure is about 200 lb. per square inch higher and the temperature about 100 deg. F. higher than that used at Trenton Channel and Delray No. 3 and represents about the highest steam pressure and temperature used in turbines operating on the simple regenerative cycle in commercial use in this country.

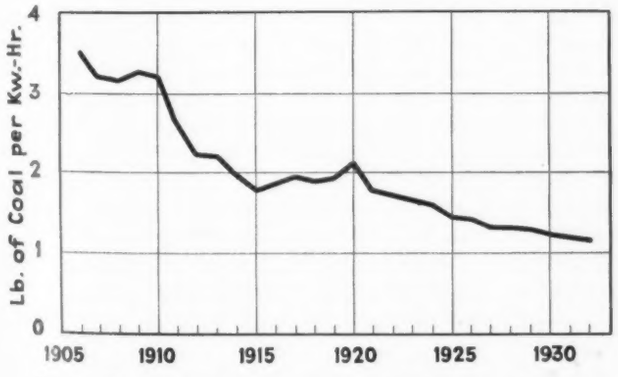
The first step in the program of installing new equipment is now well under way. The first two boilers installed in 1914 have been removed to make room for the new higher pressure steam generators. The new boilers are to be a modification of the old type W Stirling boilers first used in Power house No. 2 at Delray and later at the Connors Creek, Marysville and Trenton Channel power houses. Each boiler will have a compensating superheater, twin economizer and preheater. The furnaces will be of the so-called water-wall construction and will be fired by double-ended underfeed stokers.

The first two main turbines will be of 30,000 kw. capacity each and will be partly constructed from parts of the first two 20,000-kw. turbines at Connors Creek and parts of two 30,000-kw. turbines, one of which is located at Delray power house No. 2 and one at Connors Creek, where it was installed in the period immediately following the war as a temporary relief to permit taking out of service other units which were in need of extensive repairs. The complete generators of the 30,000-kw. units are in excellent condition and will be reused without alteration.

The turbine foundations, condensers and condenser auxiliaries now serving the 20,000-kw. turbines will continue to serve the rebuilt turbines. Some alteration in the tube arrangement of the condensers may be made if sufficient improvement in performance is believd to warrant such changes.

When this present project has been completed, with two rebuilt turbines, two new high-pressure steam generators and all necessary auxiliary equipment, that portion of the Connors Creek power house will be the most efficient generating group in the Detroit Edison system. It is impossible to predict what the average coal consumption per kilowatt-hour for the entire station will be because of our inability to forecast accurately that portion of the total load on the station which will be carried on the new units. However, that portion of the total net plant output delivered from the new units will probably be at the rate of something less than one pound of coal per kilowatt-hour. If this process of rehabilitating the remainder of the plant is carried on to completion in the future, when and as needed, the entire output from the plant will be at an equally low coal rate.

The extent of the reduction in the amount of coal required per net kilowatt-hour of output over the past 26 years is shown by the accompanying curve. Whereas there does not appear to be a possibility of continuing the improvement as rapidly as has been done in the past, it is quite probable that there will continue to be improvements from year to year and that, to some extent, this will be accomplished by means similar to those being followed at Connors Creek.



Reduction in unit coal consumption over 26 years

Improvement will continue, but it does not appear to be a possibility to continue the rate of reduction obtained in the past.

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Diversified Engineering Service Rendered Subsidiaries

Considerable light upon the variety of engineering services performed by the New England Power Association's management organization for subsidiary properties was recently brought out in the Marlboro Electric Company rate case before the Massachusetts Department of Public Utiliteis by W. C. Bell, vice-president New England Power Engineering & Service Company. In contravention of contentions that the cost of engineering services by holding company organizations tends to reach excessive figures, Mr. Bell submitted a list of various engineering tasks performed for the Marlboro company during the past two years for which the company was billed in addition to the routine fee charged for management. A few of these tasks and the charges to the nearest dollar are appended, to show by specific examples what a variety of work is done in this way:

Valuation for fire insurance coverage, $3; supervision of meter records, testing and inspection, $472; relay maintenance, $524; radio investigation, $16; municipal tax investigation, $10; preparation of maps and forms, $48; appliance testing, $94; compiling electrical statistics, $46; preparing maintenance schedules, $17. Engineering studies included: Additional street lighting transformer in Northboro, $183; proposed new substation in Bolton, $62; installation study of 13-kv. equipment at Berlin, $202; study of additional relaying to permit operation of air-break switches at Marlboro Junction, $119; study of installation of air-break switch on loop, $45; spare transformer at Northboro, $24; pole replacements, $16; improving operation of Westboro loop, $78. Other investigations included the secondary system in the Marlboro district, $1,715; rehabilitation of a 6,900-volt line, $104.

A large amount of minor construction work was also handled by the service corporation, with some important substation and line improvements on which the regular contract percentage fees were charged.

Higher Distribution Circuit Capacities Is the Trend

By S. H. FARACE

Electrical Engineering Division, Philadelphia Electric Company

SINCE the early post-war years the prevailing capacity of radial circuits in the two-phase, 2,400-volt, three-wire distribution system supplying the city of Philadelphia has been increased from 100 amp. to 150 amp. to 200 amp. In the course of the passage from the lower to the higher capacities the number of lower capacity circuits has been reduced with the view toward ultimate elimination. Two higher capacities, the 400 amp. and the 300 amp., were introduced in 1929 and 1930 respectively. The number of 400-amp. circuits, which at the present time amounts to only 2 per cent of the total circuits, is not expected to increase rapidly as the use of this circuit has been found advantageous only in the high load density underground area in the central business district. General use, however, is planned for the 300-amp. circuit.

This plan contemplates a reduction in number, but not the elimination, of the present prevailing 200-amp. circuits due to the fact that economic advantage is anticipated in combining the use of 200- and 300-amp. circuits in an ultimate 1:1 ratio. The number of 300-amp. circuits has already increased to 20 per cent of the total circuits. As a result of the upward trend in individual circuit capacity the average capacity has increased 48 per cent since 1921.

The trend toward higher circuit capacities has been dependent upon the greater conductor loading permitted on the basis of allowable voltage drop, particularly in aerial circuits, by (a) the increasing load density, (b) the increasing number of substations, (c) the higher percentage of underground cable in circuit feeders installed primarily to avoid the hazards of pole line congestion and (d) the greater maximum outgoing circuit voltage made available by the variation of bus voltage in generating stations scheduled to conform with daily and seasonal load changes.

Substation outlay conserved

Use of higher capacity circuits has figured prominently in the reduction of ultimate substation investments through the medium of larger individual substation capacities. This is particularly true of the 300-amp. circuit in connection with the recent plan to increase by 25 per cent the capacity of existing and new substations of the standard design. The savings inherent with larger capacity substations, irrespective of individual circuit capacities, are the reduction in investment for spare facilities and the postponement of charges on investments for new substations. Additional savings, represented by reductions in building and land investments, are dependent upon space required for the additional circuit, transformer bank and transmission line capacities.

The design of the standard substation building is such that an increase of 25 per cent in transformer bank and transmission line capacity requires no additional building content. It would be necessary, however, to enlarge the building if the corresponding increase in circuit capacity were obtained by installing more of the 200-amp. circuits. This necessity has been avoided by the use of 300-amp. circuits due to the fact that the equipment for this circuit fits in standard compartments. The total savings expected from the desired increase of substation capacity is, therefore, maximum.

Savings in substation circuit equipment have resulted also from the use of 300-amp. circuits. In this respect the usual tendency toward lower costs with increasing capacity has been accentuated by the fact that major pieces of equipment hitherto standardized for the lower capacity circuits can be used also for the 300-amp. circuits. The only new items required are reactors for all circuits and regulators for some. Oil circuit breakers and disconnect switches for 200-amp. circuits have capacity sufficiently large to permit their use on 300-amp. circuits. The number of new 300-amp. regulators has been reduced to a minimum by utilizing available 150-amp. 10 per cent regulators reconnected for 300-amp. 5 per cent operation when the regulating requirement does not exceed a plus or minus 5 per cent range. A large number of these regulators, similarly reconnected, are now in service on 200-amp. circuits as the result of the transition of the prevailing circuit capacity from 150 amp. to 200 amp. The conversion of many existing circuits for the 300-amp. capacity at substations where 150-amp. regulators are in service either on 150- or 200-amp. circuits can be effected, therefore, without the purchase of new regulators.

Two-hour overload of transformers

The effect of economic factors involved in the design of feeders for 300-amp. aerial circuits, referred to later, limits the number of these circuits in substations outside the central district to 50 per cent of the ultimate total. An increase of 25 per cent in total transformer bank capacity, therefore, is sufficient to match the increase in circuit capacity. This has been obtained by operating the 7,500-kva., 13.2/2.4-kv. Scott-connected air-blast banks provided for in the standard substation design on the basis of a two-hour emergency overload rating of 9,500 kva. The ultimate firm capacity of the four-bank substation can be increased, therefore, from 22,500 to 28,500 kva. (one bank out of service). The additional transmission line capacity is provided simply by the installation of one 6,000-kva., 13.2-kv. line.

The only change in outside equipment made for the 300-amp. circuit is the increase in size of feeder cable. Three-conductor, 500,000-circ.mil cable has been standardized for these circuits. All 300-amp. circuits, how-

ever, are not equipped with this cable size. In the conversion of existing circuits use is made also of 250,000-circ.mil cable. Pairs of circuits are usually involved in such conversions. A 500,000-circ.mil cable is installed for one of the pair, thereby releasing one 250,000-circ.mil cable. The released cable is then extended, if necessary, and paralleled with that of the second circuit. Sectionalizing facilities are provided in two-cable feeders. This process can be continued as long as there are spare ducts available, after which it is necessary to increase the number of ducts or to withdraw existing cable for the installation of the larger cable.

One mile radius established for 300-amp. circuits

Notwithstanding the greater load to be transmitted, the No. 2/0 aerial wire which has been standardized for 200-amp. and lower capacity circuits is used also without exception for the 300-amp. circuit, a practice which makes the use of this circuit for load centers in the outer zone of substation areas undesirable. On the basis of equal distances to centers in this zone the minimum length of feeder cable, when combined with aerial wire, would be greater for a 300-amp. circuit than for a 200-amp. circuit. To avoid offsetting the savings in substation investments the 300-amp. circuits are confined to the area close to the substation. The radius of this area, represented by the maximum distance over which the normal load can be transmitted by an all-aerial feeder without exceeding the allowable voltage drop, is about one mile. The ultimate number of 300-amp. circuits which would be useful will depend upon the load in the area of limitation at the time the load on the substation is equal to the ultimate transformer bank capacity. It is estimated that this number will be equal to 50 per cent of the total circuits.

No savings in outside plant investments are expected as a result of the advent of 300-amp. circuits. The installed cost of 500,000-circ.mil cable per kva. of capacity is practically the same as that of the 250,000-circ.mil cable when used for 200-amp. circuits. The savings in duct and aerial feeder investment which would accrue inherently from the use of 300-amp. circuits will very likely be neutralized by increases in duct and cable investments resulting from the conversion of existing circuits, particularly when it becomes necessary to withdraw existing cables to permit the installation of larger cable.

The trend toward higher circuit capacities has advanced through the medium of increased current ratings. This suggests an inquiry into the limitation to the continued application of this procedure. Basic factors to be considered are (a) the relation between cost and current-carrying capacity of cable, (b) avoidance of undesirable large size aerial conductors in combination aerial and underground feeders which may involve the extension of cable and conduit directly to the load centers, (c) bore of existing ducts which may preclude the use of the required larger cable size, (d) reconstruction of existing circuit compartments to permit the installation of larger circuit equipment, and (e) the possibility of having to scrap prematurely much of the existing equipment both in and outside of substations. In addition to these economic factors, increased line exposure and number of customers per circuit must be taken into consideration with respect to circuit failures and good customer relations.

Standard Design for Street Lighting Bracket Fixture

In working out overhead construction standards for subsidiary properties the New England Power Engineering & Service Corporation has devised a convenient design of drop wiring and series street lighting head, illustrated herewith. Experience dictated abandonment of the former practice of feeding series street lighting units by conductors carried inside the pipe bracket supporting the lamp fixture. In the interests of increased reliability

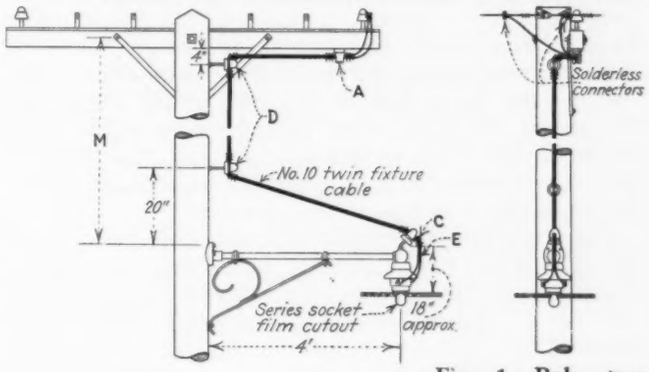

Fig. 1—Pole drop wiring and street lighting head avoids pipe grounds

(A) Screw insulator on side of arm when it would otherwise interfere with communication equipment.
(B) Head should be attached after bracket is installed on pole.
(C) Tie fixture cable with T.B.W.P. copper wire or marline cord.
(D) When necessary use intermediate drop insulators to provide a uniform spacing not exceeding 6 ft.
(E) Tape crotches at each end of twin fixture cable with rubber and friction tape. Paint with P.B. insulating paint.

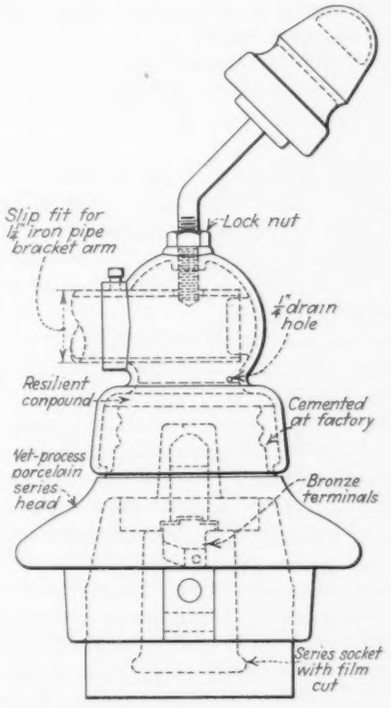

Fig. 2—Series street lighting head with adjustable guide insulator

of service and safety the company has adopted two types of drop feed outside the bracket pipe, one applying to distances under 15 ft. below the crossarm and an alternate method applicable to greater distances or situations where communication circuits intervene. The former or direct drop method provides a short run of No. 10 B&S twin-fixture cable from the breaker insulator on the

crossarm down to a standard series street lighting head carried at the end of the pipe bracket. The latter (Fig. 1) provides for carrying the twin-fixture cable down the pole with intermediate drop insulators when required to provide uniform spacing not exceeding 6 ft.

A valuable feature of the standard design is a series street light fixture and a head (Fig. 2), with provision for accurate lining up of the pin type guide insulator above the outer end of the bracket, which supports the twin-cable en route from the crossarm to the head holding the lamp unit.

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READERS' FORUM

Selling the Rehabilitation Market

To the Editor of the ELECTRICAL WORLD:

I have read with great interest the editorial entitled "Selling the Rehabilitation Market" in the September 30 issue of the ELECTRICAL WORLD. This article, with others of like tenor appearing elsewhere from time to time, serves rather well to direct attention to some conflicting urges in industry and commerce.

The production of capital goods and plant in our boom period seems to have had more to do with the concurrent alleged prosperity than the corresponding production and use of consumable goods, hence the rehabilitation urge.

Scrapping and replacing of existing workable but not up-to-the-minute plant to make way for the latest and most efficient equipment under a rehabilitation program, as advocated, implies "dollar engineering," which, in my judgment, due to its cold-blooded application in the past, has brought this country and the world to its present economic sickbed.

The expression "dollar engineering" is most offensive, in my opinion, as it implies no consideration of social or commercial balance in the employment of capital and labor in industry, so essentially necessary to the welfare of capital (the surplus offspring of labor) and labor (the fundamental source of capital).

In a previous letter to you (October 22, 1932) I pointed out the probable wisdom of supplementing cold "dollar engineering" conclusions with a consideration of the possible underlying social and commercial consequences of narrow or dollar expedient decisions. It is not probable that moneymongers go far or even at times desire to see far in this direction, and so long as, and to the extent they control industry, "dollar engineering" is likely to prevail.

I hold the opinion that dollar philosophy also seriously affects the judgment of labor itself, contagiously perhaps, but more likely because of high-pressure methods of creating investment urges in the minds of every one able to get hold of a surplus dollar. If this surplus finds employment in a *sound* and *necessary* capital undertaking, well and good, but is it generally realized how much of it has found an early and permanent grave in purely promotional ventures? I contend, therefore, that a high wage is not necessarily a sound wage, because of the danger of creating capital funds too rapidly for their sound absorption.

Even if it is granted that material prosperity depends upon immediate and repeated rehabilitation of capital plant intended to create or prolong business and commerce, it is evident that "dollar engineering" must show that the savings due to such rehabilitation will not only justify the scrapping of the old plant but also provide surplus earnings enough to amortize quickly the new plant. This latter principle is too often ignored in rehabilitation programs. Such a procedure, unless regulated as well by other sound conclusions, is likely to provide for the continuance of the vicious whirl which now afflicts us.

A "dollar engineering" conclusion moreover, in my opinion, is futile if it is predicated, on the one hand, upon a constant production of capital goods to insure constant employment of labor, since to be consistent it must, on the other hand, require that these capital goods shall be produced with a constantly decreasing increment of labor, because reduction in the labor increment is the foundation of "dollar engineering" economic rehabilitation. It is not difficult to comprehend, therefore, that straight "dollar engineering" tends accumulatively to destroy purchasing power of the masses and the resulting commerce, both of which comprise the veritable foundations of a successful capitalistic system.

Let us not kill or even partly strangle the goose that lays the golden eggs for both labor and capital. May I quote from the concluding words of Philip Cabot's address before the Pennsylvania Electric Association on September 8, 1933, with the hope that his profound reasoning will not completely rebound from eardrums regularly attuned to other lines of thought.

" . . . To serve the state you must forget yourself and the interests you have served. The habits of a lifetime must be reversed. To serve the state or any one else effectively you must be utterly selfless. Perhaps that is too much to ask, but I say to you in all seriousness that in this emergency that is your safest course. You will best serve your own interests and the interests of your own company by forgetting them for the time being. Unless the freedom and the integrity of the states can be preserved there will be no freedom for any of us. . . . "

In conclusion, I repeat that straight "dollar engineering" is economically unsound, and will remain so just as long as its application ignores underlying or contingent social and commercial reactions. When it includes these fundamentals it becomes engineering for humanity.

W. H. COLE.

Boston, Mass.

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Built by Oerlikon Company

To the Editor of the ELECTRICAL WORLD:

You give in your number of August 19, 1933, under the heading "Down-Stream Tunnel Adds Head," an abstract of a description of the recently completed "Limmatwerk" at Wettingen, Switzerland, published in the *Schweizerische Wasser- und Energiewirtschaft*.

You state that the three vertical three-phase, 10,000-kva. generators were supplied by Brown, Boveri & Company, whereas these machines were manufactured and supplied by our firm.

Ateliers de Construction Oerlikon.

Oerlikon, Switzerland.

Men of the Industry

CHARLES W. TAGGART, general manager of the gas and electrical department of the city of Norwich, Conn., has relinquished these duties after thirteen years of service.

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S. O. HARGUS, private secretary to Governor Park of Missouri, has succeeded D. D. McDonald as general counsel to the State Public Service Commission. Mr. Hargus has been private secretary to the Governor since the executive took office in January.

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S. B. NELSON, a consulting engineer of Kansas City, Mo., succeeded J. E. Flanders as chief engineer for the Missouri State Public Service Commission on October 1. Mr. Flanders will become valuation engineer on the staff of the commission.

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SIDNEY D. MAHAN, advertising executive, has been appointed merchandise advertising manager of the Westinghouse Electric & Manufacturing Company with headquarters in Mansfield, Ohio.

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CHARLES F. NORTON, formerly vice-president and general manager of the Howell Electric Motors Company, has affiliated himself with the Louis Allis Company, Milwaukee, in an executive sales capacity.

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R. I. PETRIE, formerly sales manager of the Leonard Refrigerator Company, division of Kelvinator, has been appointed sales manager of Kelvinator Corporation to succeed J. S. Sayre, who resigned to join Montgomery Ward & Company.

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GODFREY STRELINGER, formerly manager of branches for Kelvinator Corporation, has been appointed sales manager of the Leonard Refrigerator Company of Detroit and Grand Rapids, to succeed R. I. Petrie. Mr. Strelinger took over supervision of all the Kelvinator branches in 1929. He handled this work for three years and then became manager of the Kelvinator branch in Detroit, which position he held for a year and a half until his recent appointment.

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ROB ROY MACLEOD, public relations manager of the Buffalo, Niagara & Eastern Power Corporation, was elected director, vice-president and general manager of the Bradford Electric Company, Bradford, Pa., following a meeting of the board of directors held last week. Mr. Macleod succeeds WILLIAM H. BROWN, who has resigned to enter the engineering department of Buffalo, Niagara & Eastern. WALTER J. THOMPSON has been named public relations manager of the company to succeed Mr. Macleod. Mr. Macleod has been connected with public utility work for the past ten years, for the past seven of which he has been identified with the power industry on the Niagara frontier in Buffalo and Niagara Falls.

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GEORGE C. MATHEWS, for the past few months a vice-president of the Middle West Utilities Company, will assume his position as a member of the Federal Trade Commission in the near future. Mr. Mathews was formerly identified with the Wisconsin Public Service Commission and during 22 years of service was in charge of the statistical, rate and accounting departments and of the blue sky division. Last spring he was appointed by Edward N. Hurley and Charles A. McCullough, receivers of the Middle West Utilities Company, as an expert on utility rates.

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DR. COLIN G. FINK, professor of electrochemistry at Columbia University, has been elected to receive the Perkin medal of the Society of Chemical Industry for 1934. The medal is awarded annually for valuable work in applied chemistry and will be presented this year to Dr. Fink for his inventions in the fields of metallurgy and electrochemistry. Presentation of the medal will be made at a meeting in New York early in January, details of which will be announced later.

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OBITUARY

EMERSON L. COLLINS, an attorney, former legislator and for five years a member of the Pennsylvania Public Service Commission, died October 10, after a long illness. He was in his 74th year. Mr. Collins was appointed to the Public Service Commission by Governor Fisher in 1927. He resigned last year.

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DANIEL BOYLE, a member of the Montana Railroad Commission for a number of years, died September 11. Mr. Boyle was elected to the railroad and public service commission in 1908 and, save for two years, served on that board continuously until failing health compelled his resignation last November.

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MYRON F. WESTOVER, who retired in 1928 after having been secretary of the General Electric Company for 34 years, died at his home in Schenectady, N. Y., October 21, at the age of 73 years. Starting as secretary to Charles A. Coffin, then treasurer and manager of the Thomson-Houston Electric Company, a predecessor of the General Electric Company, Mr. Westover was elected assistant treasurer of the new General Electric Company in 1893 and in the following year was elected secretary.

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CHARLES F. CONN, secretary and treasurer of the J. G. White Engineering Corporation, New York, died suddenly, October 20, at his residence, the Engineers Club. He was 61 years of age. Early in his career Mr. Conn was identified with the Flatbush Gas Company in Brooklyn, with the Electric Light & Power Company of Yonkers and with the General Electric Company as sales engineer in the transformer department. He joined the J. G. White interests in 1907. Mr. Conn was a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers and the American Society of Civil Engineers.

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M. DE LE PAULLE, vice-president of the International Commission on Illumination and president of the Belgian National Committee, died recently. M. de le Paulle visited the United States to attend the International Illumination Congress in 1928 and had an extensive acquaintanceship among electrical men in this country.

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EDSON L. MORRIS, sales engineer with the Westinghouse Electric & Manufacturing Company in Salt Lake City, died October 6, following an operation. He was 28 years of age. Born in Lewiston, Idaho, and a graduate of the University of Idaho, he went to Pittsburgh, Pa., where he was a student at the Westinghouse electrical school. Four years ago Mr. Morris became identified with Westinghouse in Salt Lake City. He has served as chairman of the Salt Lake section of the American Institute of Electrical Engineers.

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KING L. PARKER, formerly vice-president of the Emerson Electric Manufacturing Company, St. Louis, Mo., died suddenly October 19. Mr. Parker had been in ill health, retiring from active participation in the company's business several years ago. After graduation from Yale University in 1916, he held various positions with the Emerson company, of which his father was the founder, and in 1923 was elected to the position of vice-president. Mr. Parker was 40 years of age.

New Equipment Available

High-Speed Timing Device

A high-speed timing device which gives a visual instantaneous indication of minute time intervals by dividing one cycle of a 60-cycle wave into 60, 100 or even 1,000 parts has been announced by the Westinghouse Electric & Manufacturing Company. Although used in the laboratory to show the fraction of a cycle required for a high-speed relay to operate, the method could be used for measuring the time of an operator to apply brakes of an automobile after receiving a signal, the reaction time of an individual during psychological studies, or measurement of elapsed time of almost any brief event.

The timer can take any of several different forms. One method for dividing one cycle of a 60-cycle wave into 60 parts uses a synchronous-motor-driven disk, rotating behind a shield. Numbers from zero to 60 are cut through the disk at the periphery. As the disk rotates these numbers pass before a viewing slot in the shield. Behind the disk and in line with the slot is placed a neon light which is arranged to flash at the end of the period under observation.

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Capacitors for Power-Factor Correction

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has announced a complete line of capacitors, static condensers, for power-factor correction. These capacitors have an efficiency of 99¾ per cent or better and are characterized by low temperature rise, 2 deg. C. or less, assuring practically unlimited life. An outstanding feature is their unit type construction as these capacitors are an assembly of small, independent, hermetically sealed can units.

The capacitors are made for all voltages up to 4,600, for any frequency and phase arrangement and in any size desired.

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INSIDE FROSTED TUBULAR "MAZDA" LAMPS of 250 watts for special use in indirect portables have been announced by the General Electric Company. These new lamps, designed for base down burning only, are much smaller in size and consequently allow more efficient control of the light. Actually, the 250-watt lamp in properly designed equipment will produce illumination of an intensity equivalent to the 300-watt lamp when used in present-day indirect portables. Having an over-all length of only 6 in., a T-16 bulb and a medium screw base, the lamp meets the demand of portable lamp manufacturers for a light source that will allow greater flexibility in the design of their product.

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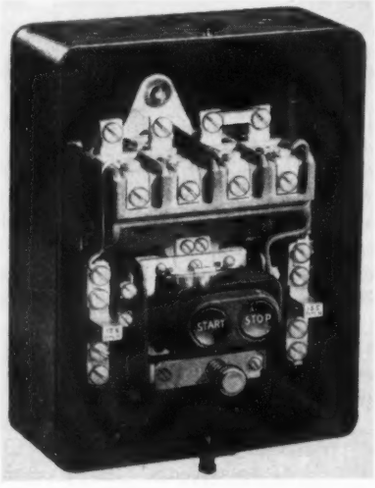
Across-the-Line Starting Switches

Solenoid-operated across-the-line starting switches rated at 5 hp., 220 volts; 7½ hp., 440-550 volts for polyphase motors and up to 1½ hp., 110 volts; 3 hp., 220 volts for single-phase, self-starting motors have been announced by



the Allen-Bradley Company, Milwaukee, Wis. They are made in three forms, with start and stop push buttons, without push buttons for thermostat or remote pilot control and with two-way hand automatic switch for try-out control installations.

A distinctive feature is their small cabinet dimensions, obtained by substantially reducing the size of the switching mechanism. Adequate wiring space is therefore provided in the cabinet. Double-break silver alloy contacts have reduced contact maintenance and increased contact life. A new patented arc hood suppresses the arc so completely that locked rotor currents of motors several times the switch rating can be broken without flashover or distress.

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ARROW-HART & HEGEMAN ELECTRIC COMPANY, Hartford, Conn., announces a new line of TS time-saver switches. They are designed specifically for modern type C lamp loads and are enclosed in compact bakelite bases. The type C mechanism is fully enclosed and sealed, making a dust-proof switch.

Oil-Immersed Magnetic Switch

Designated as CR7006, an oil-immersed, magnetic switch for use in corrosive atmospheres where class 1, group D control is not required has been developed by the General Electric Company. This switch is designed for controlling motors which can be started on full voltage.

The equipment consists of a standard General Electric magnetic switch with special coils and special contact tips for operation under oil. The inclosure is a square sheet metal oil tank with a heavy boiler plate top cover. The switch is available in three sizes for various horse-power ratings. The sizes are CR7006-V11, 3 hp. at 110 volts, 5 hp. at 220 volts, 7½ hp. at 440 and 600 volts; CR7006-V12, 7½ hp. at 110 volts, 15 hp. at 220 volts, 25 hp. at 440 and 600 volts; CR7006-V13, 15 hp. at 110 volts, 30 hp. at 220 volts and 50 hp. at 440 and 600 volts.

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A MEDICAL EXAMINATION UNIT which is a clinical appurtenance of impressive appearance and dual use has been announced by the Holophane Company, New York. It has a white porcelain enameled bowl which gives uniform, glareless, indirect illumination over the entire room for general lighting. For clinical examination a turn of the pendant control rod uncovers a control lens in the bottom of the unit, sending a powerful concentrated beam of light to the examination area.

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EDWIN L. WIEGAND COMPANY, Pittsburgh, Pa., manufacturer of Chromalox heating units, announces a line of temperature controls for use in connection with various heating applications. The line comprises devices for indicating and controlling temperatures in tanks, machines, hydraulic press platens, ovens and furnaces, melting pots and other equipment. Thermostats for controlling the temperature of electric units used for heating rooms, isolated shops and offices are also included.

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VAPOCARB CONTROL of the Hump furnace atmosphere, which protects the surface of each piece, has been announced by the Leeds & Northrup Company, New York. The "Vapocarb" atmosphere in the Hump furnace protects the carbon in the surface of the steel. It gives maximum efficiency from the quench because every piece comes from the furnace clean; maximum grain refinement is secured for a given depth of hardness; surface hardness is uniform over each piece; the surface hardness of the average piece equals that of the best.